ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

MARCH 15, 1941 • 61st YEAR

In This Issue

Fluorescent Street Lighting Progress

•

Station Reliability at $128 per Kw

•

Radio-controlled Rural Subs

Portable Emergency Substation

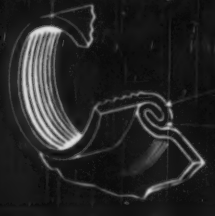
WRENCH IT!
Interlocked—seam hubs won't give, turn or break off!
SOCK IT!
If abnormal abuse should deform the steel, just bend it back again — the interlocked-seam hubs will stay watertight!
DROP IT!
Even screwed onto a twelve-foot length of conduit, this socket takes terrific punishment!

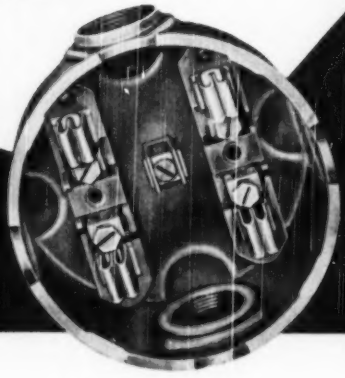
NOW!

NEW STRENGTH!
NEW STAMINA!
NEW ENDURANCE!
in the IMPROVED
Murray
Steel METER SOCKET

How do we do it?

Take a look at this precision interlocked seam that anchors hubs to shell in the improved Murray meter socket. Engineers said it couldn't be done — yet here it is. Rigid, rugged, waterproof — these hubs *can't* loosen up, *can't* fall out, *can't* break off. No welds, no die castings, no flimsy alloys — just tough, sturdy, dependable steel.





Murray
MANUFACTURING CORPORATION

50 Years of Service to the Electrical Industry

1250 ATLANTIC AVENUE • BROOKLYN 16, NEW YORK

The *improved* Murray steel meter socket is weatherproofed by zinc coating and baked-on melamine finish. Two or three hubs, size 1" or 1¼"; four, five or six jaws. Reversible jaws for horizontal or vertical mounting. Solderless connectors can be swung into the gutter for bussing. Connectors take No. 1 wire.

The *improved* Murray meter socket is available either separately or in this preassembled yard-pole combination with Murray fully magnetic circuit breaker protection, approved by R.E.A. Write for complete specifications.

SERVICE ENTRANCE & METER EQUIPMENT • MAGNETIC CIRCUIT BREAKERS
SWITCHES • CURRENT LIMITING REACTORS • CROWS NEST AERIAL LADDERS

Of Personal Interest

For a long time Frank Innes has been keeping tab on commercial activities in the utilities and reporting what he saw to Electrical World readers. A good many times he has dug right down to the roots of load-building problems, but we doubt if he ever watched the commercial departments more closely than right now.

He has good reasons.

We know that the cost of new capacity is a lot higher than before the war and that a lot more kilowatt-hours will have to be sold in order to earn a return on this higher cost. And we know, too, that the surest way to sell more electricity is to sell more appliances and other devices to consume it. Since residential customers are the most numerous and revenue from them is largest, it doesn't take a long-whiskered economist to see that the sale of residential appliances is now a consideration of top-drawer importance.

Some months ago we decided to find out as much as we possibly could about what the utilities are doing, and plan to do, to build residential and other loads.

Naturally, Frank Innes got the job, and he plunged in with what we expect to be a resounding splash.

Through a long and carefully-planned questionnaire, prepared in consultation with many experts, he asked 22 probing questions of a hand-picked list of commercial department executives.

Returns were over 43%—a whale of a score in any survey, but truly remarkable for a questionnaire as complicated as this one. We expect this study on utility merchandising to be one of the most important articles we've carried in many months. It's coming March 27.

Maybe there was **one** time when Frank Innes was more interested in appliance sales than he is now. In college he sold electric irons, door to door, for the Washtenaw County Edison Co. That wasn't his first job in the industry, though.

He started out as a swipe for the Port Huron Light & Power Co. Then he was a meterman, a distribution engineer and a lighting engineer, before he joined Electrical World.

Cordially,
THE EDITORS

P.S. In this column, from now on, we'll try to bring you notes of interest concerning the people who make Electrical World, and what's coming.

ELECTRICAL WORLD

Published for 76 years for those engaged in the business of generating, transmitting, distributing or applying electric power

VOL. 133 No. 11 CONTENTS MARCH 13, 1950

Editorials 67

News: The Electrical Week Washington Comment Technical Notes 69

What of Fluorescent Street Lighting ..... By J. R. Rutherfoord 79
Hold promise, but a lot of work remains to be done

Better Utility Warehouse Handling Methods 82
How a utility handles more materials faster—with the same manpower

Carrier Relaying Aids Tie Line Operation ..... By Herbert L. Goodridge 84
A report of twelve years experience with carrier relaying

Standardized Maintenance Manuals Save Manhours By Clayton M. Allen 87
Records of major equipment overhauls guides work on similar units

Reliability Plus Economy Marks B C Cobb Station 88
How designers built three kinds of economy into a new station

Controlled Water Heating Costs Less ..... By Millard C. Westrate 92
Does off-peak water heating have the edge over uncontrolled service

Very Thin Tapes Reduce Cable Insulation ... By L. Domenach, L. I. Komives 94
Test results on cable made in France and tested in Detroit

Radio Control for Rural Substations ..... By Norman S. Kent 96
VHF channels provide voltage, lockout alarms, remote reclosing

More Transmission Capacity at Lower Cost ..... By H. W. Hanson 98
Paralleling of transformers and conversion to 132 kv permits saving

Departments

How To	102	Manufacturers and Markets	142
Engineering Reference Sheets	110	New Electrical Construction	146
Load Building	118	Catalogs and Bulletins	149
New Equipment	124	Books	150
News About People	136	Letters	152

Index of Advertisers 158

* * *

RALPH H FLYNN, Publisher FISCHER BLACK, Editor DANIEL T BRAYMER, Managing Editor

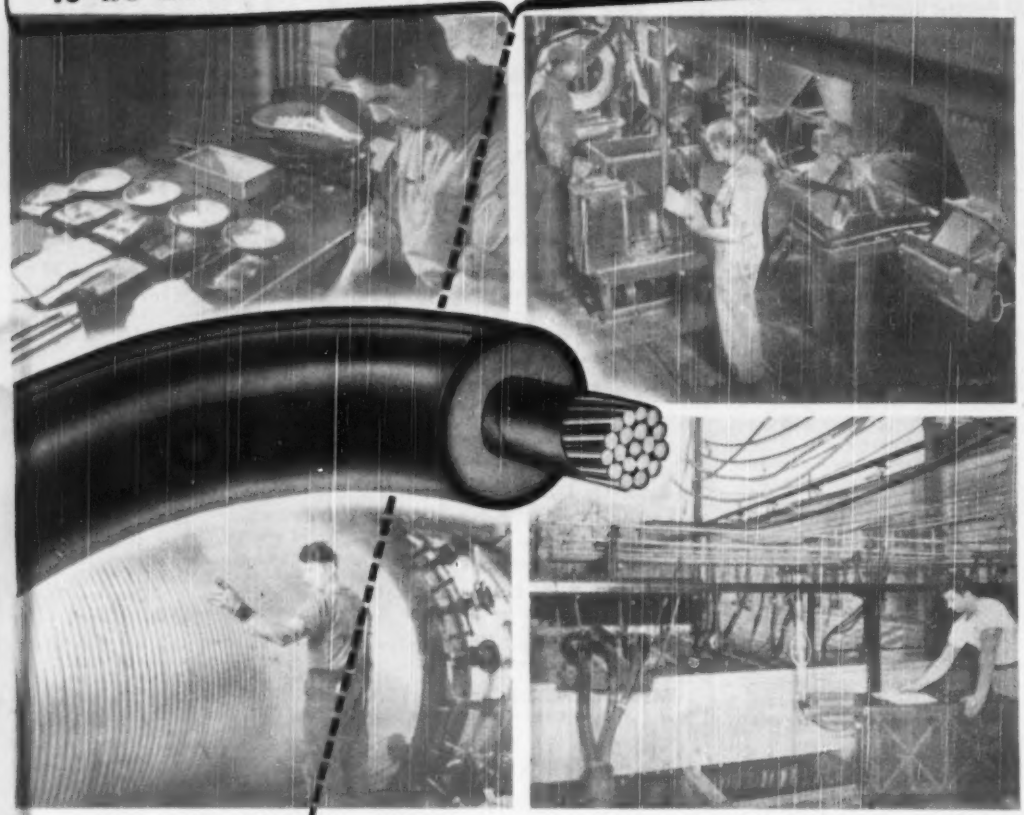
ARCHER E KNOWLTON, Senior Associate Editor
FRANK R INNES, Associate Editor
ROBERT C BLATT, Associate Editor
W B WHICHARD, Associate Editor
RUE M SHOOP, Assistant Editor
FRANCIS J KOVALCIK, Assistant Editor
KENNETH K KOST, News Editor
LOIS A STEWART, Assistant News Editor
JOSEPH A ROBINSON, Pacific Coast Editor
HOWARD S KNOWLTON, New England Editor
EDWARD ALLEN, Midwestern Editor
EARL CARVER, Art Editor
BERLON C COOPER, Lighting Consultant
GEORGE B BRYANT, JR., Mgr Washington Bureau
RONALD D ROSS, Washington Correspondent

WORLD NEWS BUREAU, Russell F Anderson, Editor; London, Paris, Frankfurt, Moscow, Tokyo, Bombay, Melbourne, Rio de Janeiro, Buenos Aires • DOMESTIC NEWS BUREAUS, Atlanta, Chicago, Cleveland, Detroit, San Francisco, Houston. Correspondents in 43 principal cities • ECONOMICS DEPARTMENT, Dexter M Keezer, Director; William F Butler, Sanford S Parker, Robert P Ulin

ELECTRICAL WORLD, Published weekly by McGraw-Hill Publishing Company, Inc. Publication Office, 99-129 North Broadway, Albany 1, N. Y. Editorial and Executive Offices, 330 West 42nd St., New York 18, N. Y. James H McGraw (1860-1948), Founder; Curtis W McGraw, President; Willard Chevalier, Executive Vice President; Joseph A Gerardi, Secretary and Treasurer; Eugene Duffield, Senior Vice President, Publications Division; Nelson Bond, Vice President and Director of Advertising; J E Blackburn, Jr, Vice President and Director of Circulation. Subscription rates: Single copy 35 cents. In the United States, $6 a year, $9 for two years, $12 for three years. Canada, $7 for one year, $11 for two years, $14 for three years. (Canadian money at par.) Pan-American countries, $15 for one year, $25 for two years, $30 for three years. All other countries $20 for one year, $30 for two years, $40 for three years. Entered as second-class matter, November 16, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Copyright 1950, by McGraw-Hill Publishing Company, Inc. Permission required to reproduce any of contents. Cable address McGRAW-HILL, New York. Member ABP, Member ABC.

a NEOPRENE SHEATH is no better than its COMPOUNDING*



* *"Too much stress cannot be laid on the important fact that the best neoprene products are produced by those manufacturers who are skilled in the art of compounding neoprene."*

E. I. du Pont de Nemours & Company, Inc.

Neoprene is a raw material. With neoprene it is possible to make a cable sheath that combines resistance to weather, oils, chemicals, flame and ozone – thus increasing the life and versatility of an electrical cable. But the *use* of neoprene alone does not guarantee all its advantages.

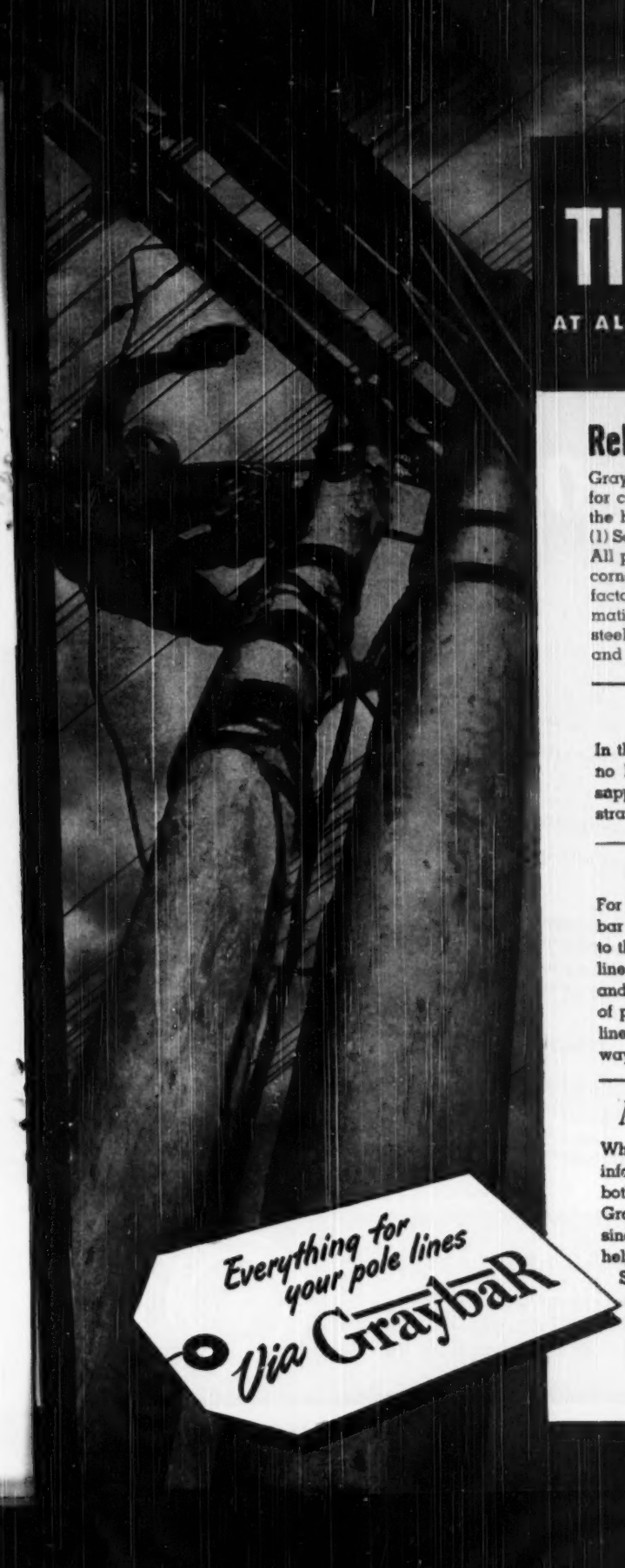
The performance of a neoprene sheath depends on experienced compounding . . . the use of ingredients that give optimum characteristics and yet assure secure bonding to the insulation . . . the skill and technique of processing, applying and vulcanizing.

The Okonite Company, originator of neoprene-sheathed cables, has been producing them for nearly 20 years. Okonite's neoprene sheath, called Okoprene, has an unequalled service record under every condition of use. Even at operating temperatures ranging from 75° C to below —18° C, Okoprene remains easy to handle and will not deteriorate. Cables protected with Okoprene do not develop harmful surface discharge.

Remember, it is necessary to compound the raw neoprene material with other ingredients in order to use it. It's the finished compound that counts. And – in these days of high installation and maintenance costs – the outstanding performance of an Okoprene sheath is more important than ever to *true cable economy*. The Okonite Company, Passaic, N. J.

THE BEST CABLE IS YOUR BEST POLICY

8108



TIGHT JOINTS

AT ALL POINTS . . . "VIA GRAYBAR"

Reliable Connectors, Splices

Graybar can supply everything your linemen need for connecting all types of lines *securely*. Two of the high-quality Reliable items we distribute are: (1) Solderless connectors—accurately cold headed. All parts are at least 98% copper, have no sharp corners, and have torque, compression, and reuse factors far above ordinary connectors. (2) Automatic splices and deadends for copper, ACSR, or steel strand—now filled with non-corrosive grease and packed to stay in perfect condition.

O-B INSULATORS

In these days of overloaded distribution systems, no line is stronger than its insulators. Graybar supplies superior-quality Ohio Brass insulators in strain, pin, and suspension types.

ONE SOURCE FOR ALL

For both transmission and distribution lines, Graybar has everything "from the bottom of the hole to the top of the pole"! By ordering all your pole-line needs from this single source, you save time and paper-work expense. You get the leading lines of poles, crossarms, insulators, hardware, strand, line trucks and tools. And you get them the quickest way possible — delivered wherever you specify.

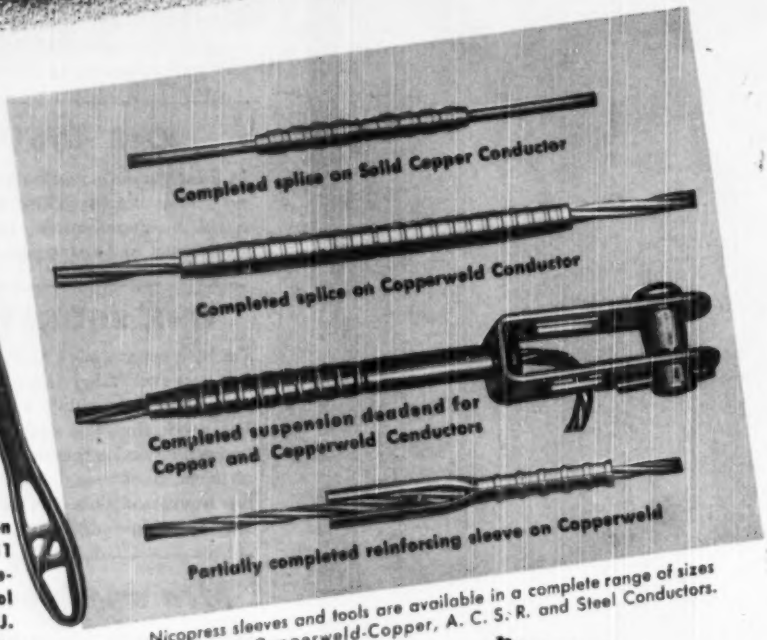
Men who know your needs

When you call on Graybar, for supplies or for information, you can expect us to meet your needs both promptly and accurately. That's because Graybar has been familiar with your needs ever since the first lines went up. You're welcome to the help of the near-by Graybar Outside Construction Specialist in planning any pole-line or underground project. *Graybar Electric Company, Inc. Executive offices: Graybar Building, New York 17, N. Y.* 5018

IN OVER 100 PRINCIPAL CITIES

"JOB PROVEN" THE WORLD OVER Nicopress

Illustration of No. 51 type Nicopress tool with P. & J. Grooves.


Completed splice on Solid Copper Conductor
Completed splice on Copperweld Conductor
Completed suspension deadend for Copper and Copperweld Conductors
Partially completed reinforcing sleeve on Copperweld

Nicopress sleeves and tools are available in a complete range of sizes for Copper, Copperweld-Copper, A. C. S. R. and Steel Conductors.

Nicopress

is the Registered Trade Mark of The National Telephone Supply Company

The National Telephone Supply Company

3100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfrs.—H. HEATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

THE NATIONAL TELEPHONE SUPPLY COMPANY

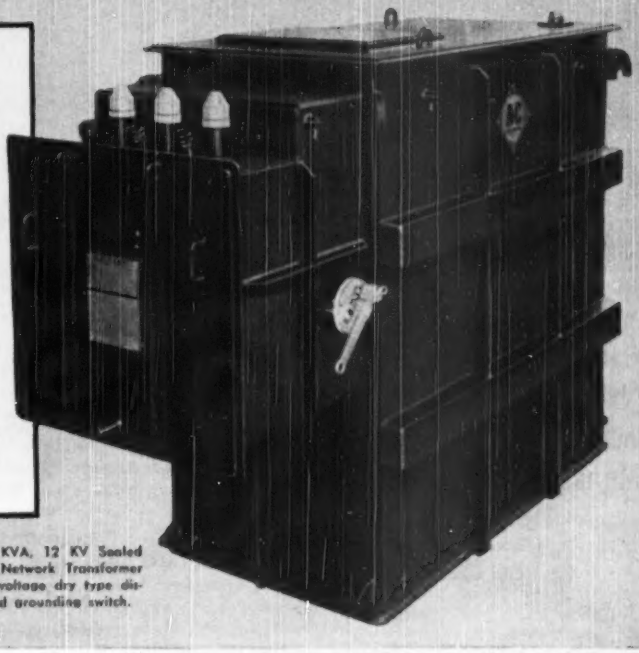
No Explosion Hazards
No Internal Maintenance

WITH SEALED DRY-TYPE NETWORK TRANSFORMERS

SAFE
Core and coils are hermetically sealed in nitrogen-filled transformer tank . . . means complete protection against flooding, dusty or corrosive atmospheres, explosion and fire.

CUTS MAINTENANCE
Dry type construction eliminates liquid filtering and testing, gauge and valve maintenance. Absence of cooling tubes reduces paint area 60%.

COMPACT
Floor space area averages no more than conventional network transformers . . . weight is 30% less than liquid filled types.



New 300 KVA, 12 KV Sealed Dry Type Network Transformer with high voltage dry type disconnect and grounding switch.

HERE'S A NETWORK TRANSFORMER that can be operated with complete safety *anywhere, anytime!* In this new unit, core and coils are hermetically sealed within transformer tank, in atmosphere of inert gas.

This sealed-in construction is possible through use of new heat-resisting Class H silicone insulations. These, combined with other inorganic materials, completely eliminate need for circulating cooling mediums.

For complete information on this new development, write today for technical paper N-328. Or contact your local A-C sales office.

A 2904

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

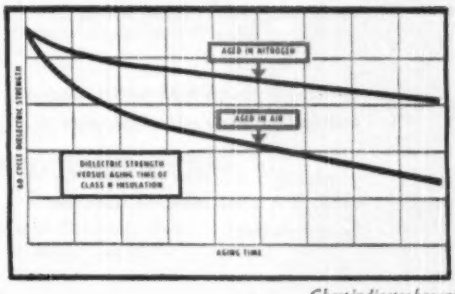


Chart indicates how nitrogen improves aging characteristics of insulation.

ALLIS-CHALMERS

Network Transformers—Nearly 1,000,000 KVA Installed

Why ANACONDA Thermoplastic Street Lighting Cable is Safer

For public safety (and good will) street lighting service must not fail. ANACONDA Thermoplastic Street Lighting Cable is:

Safer because it is stubbornly resistant to sun and weather when overhead . . .

Safer because it is ruggedly resistant to earth acids and alkalies when buried . . .

Safer because its tough hide resists abrasion and cutting when pulled into duct . . .

Safer because it is moisture-resistant and flame-retardant.

ANACONDA Thermoplastic Street Lighting Cable is available insulated with either Densheath* (vinyl resin) or polyethylene for 3,000 and 5,000 volts; with or without lead sheath.

Polyethylene may be jacketed with tough, mechanically-protective Densheath, or with flame-retardant, non-combustible ANACONDA Type FR** Compound. The latter has superior insulating properties. For complete information get in touch with your nearest Anaconda Sales Office or Anaconda distributor. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

*Reg. U. S. Pat. Off. **Trademark

The right cable for the job ANACONDA WIRE AND CABLE

Straight Connectors
All good types— in a complete range of sizes.
Tees—
Multiple, numerous clamp types, bolted, yoke-ended, teed, etc.
for the
Complete
line of Conductor Fittings — see the PENN-UNION
Catalog
Grounding Connectors
For all combinations of pipe, rod, flat bar, braid, tubing.
Lugs—
Wire, clamp types, with multi-slit sleeves; also soldering lugs, shrink fit, etc.
Service Connectors
Yoke-and-nut types; service entrance connectors.
And—
Meter sockets, bus supports, motor lead connectors, cable ties, fuse clips, etc.
And—
Terminal blocks, bare, solderless and adapters, studs and clamps, etc.

You can find the exact fitting you need in the Penn-Union Catalog— practically every good type, in a complete range of sizes. The few here can only suggest the variety.

We also have thousands of other types— new designs are constantly being added. When you need a special conductor fitting for an unusual service, our engineering staff is always ready to help you.

And— Every Connector is Dependable. When you use any Penn-Union fitting, you are sure of a connector that's reliable mechanically and electrically— carefully designed, thoroughly tested, and manufactured under rigid engineering supervision.

Preferred by Leading Users, who have found that "Penn-Union" on a fitting is their best guarantee of unfailing service.

Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORP.
Erie, Pa.

Canada: Dominion Cutout Company, Ltd., 250 Richmond St. West, Toronto

THE *Complete* LINE OF CONDUCTOR FITTINGS

PENN-UNION

No "breakdown" even after roughest handling, with this new insulation

BH "649"

What does insulation breakdown cost you? . . . In customers "soured" on your product? In salesmen explaining, instead of selling your line? In excessive maintenance?

BH "649" Fiberglas Tubing and Sleeving is proof that insulation can be toughened against abrasion. Even after rough handling and severe bending, BH "649" retains its rated dielectric strength.

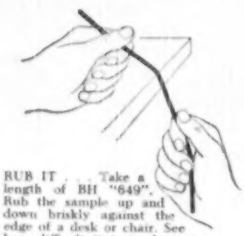
BH "649" stays supple after baking 12 hours at 300°F. No flowing, softening or blistering after 15 minutes at 425°F. Basic Fiberglas braid (1200°F) unaffected by aging.

You get this superior Fiberglas insulation at the price of ordinary cotton-base or rayon-base insulation. Often a less expensive grade of insulation can be used since there is little or no loss of dielectric strength in assembly or product use.

BH "649" is made in Grades A-1, B-1, C-1 and C-2—in all sizes from No. 24 to ⅝" inclusive. Samples furnished gladly on request.

BENTLEY, HARRIS MANUFACTURING CO., CONSHOHOCKEN, PA.

KNOT IT . . . Take a length of BH "649". Knot it. Pull it as tight as you can. Twist it. Then loosen the knot. There is no cracking. No change in the dielectric strength.



RUB IT . . . Take a length of BH "649". Rub the sample up and down briskly against the edge of a desk or chair. See how difficult it is to damage the coating.

HOLD MATCH UNDER IT . . . Take a length of BH "649". Hold a lighted match under it. BH "649" will not support combustion.

BH Fiberglas* SLEEVINGS

COUPON

Bentley, Harris Mfg. Co., Dept. W-40, Conshohocken, Pa.

I am interested in BH "649" Fiberglas Tubing and Sleeving. Send samples for production testing of Grade_____ in sizes as follows_____ (size or I.D.) for_____ (product) operating at temperatures of_____°F. at_____volts.

NAME _____

ADDRESS _____

Send samples, pamphlets and prices on other BH Products as follows:

- ☐ BH non-fraying Fiberglas Sleeving
- ☐ Cotton or Rayon-base Sleeving and Tubing

POSITIVE PROTECTION

1 OPEN ... TING GAP—Rigidly spaced to support line voltage *by* ... In horizontal position to avoid fusing-over—Permits ... inspection from ground—No trouble-some, hermetica... ed gap chamber.

2 SHORT ... TING GAP—Low impulse spark-over character... Less than 50% of standard Basic Insulatio... ls, a *field-proved* protective margin for new ... equipment—No resistor in series with disc... ath—No critical IR drop—Protected ci... subjected only to *arc voltage* which i... than 60 cycle voltage rating of the ar... even during *100,000 ampere discharg*...

2A RESTRICT... EGION around initiating gap ... high pressure during disc...

3 LONG ARC INTERRUPTING GAP—Exclusive patented arc elongation action—Arc is blown by high pressure from confined initiating gap to larger, longer arc extinguishing chamber—Arc is automatically elongated three times the initial path—This elongation and cooling of arc takes place so rapidly that follow current is suppressed and extinguished in ½ cycle or less.

Rapid movement of arc over cool fibre deionizes arc gases and eliminates erosion of critical electrode and fibre areas—An exclusive JOSLYN ARRESTER feature which prevents change in its impulse sparkover characteristic even after long service under severe system fault current conditions—Thus Positive Protection is maintained through out the life of the Arrester.

3A ARC CHAMBER at lower pressure draws arc away from initiating region, causing cooling and elongation to 3 times initiating gap—Action is so effective in suppressing and interrupting follow current that Joslyn Arresters are *unlimited* with respect to 60 cycle current rating.

Even under direct strokes of lightning, these exclusive features built into the rugged, service-proved Joslyn arrester give you

POSITIVE PROTECTION

Branch offices in principal cities

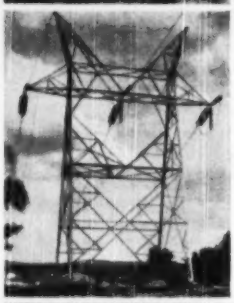
THE JOSLYN CO.
THE SOUTH EAST JOSLYN CO.
SOUTHERN JOSLYN CO.
JOSLYN SOUTHWEST CO.
JOSLYN PACIFIC CO.

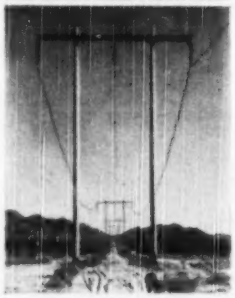
JOSLYN MFG. AND SUPPLY CO.

HIRED! A field man

FOR YOUR GOOD RELATIONS DEPARTMENT

Highest Quality Wet-Process Porcelain Shells made on the industry's finest automatic, completely hydraulic presses to assure uniformity and dependability in ALL units.





Not all good relations with the public are confined to the home office. Basically, it starts with the kind of equipment you use. Power failures won't make friends—only influence people to say adverse things about your service. Stay on the "Good" side of Good Relations. Buy Porcelain Products' dated, performance tested suspension insulators. They're built to keep working under the most extreme weather conditions. Write for prices and catalog information on our High Voltage Insulator line.

Porcelain Products, Inc.

PARKERSBURG, WEST VIRGINIA

EXPORT REPRESENTATIVE:

Philips Export Corp., 100 E. 42nd St., New York 17, N. Y. U. S. A. Cable Address: "PHILYORK"

ONE STOP SERVICE...
For CONNECTORS and BUS SUPPORTS

Southern States' revised Connector and Bus Support Catalog can help make your selection of fittings a matter of moments. It lists and illustrates fittings for all normal requirements and is completely indexed and cross-indexed for easy reference. In addition, Southern States is equipped to design and manufacture fittings for any unusual requirements.

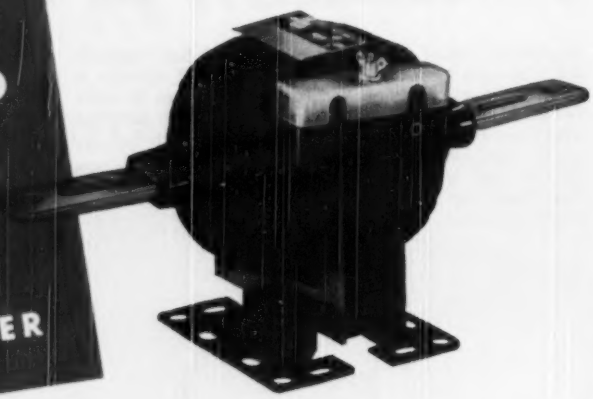
CONNECTORS & BUS SUPPORT CLAMPS
Southern States
This detailed 160-page handbook is YOURS FOR THE ASKING!
8 full pages of technical information . . . beam formulas . . . bus deflection tables . . . tubing characteristics.
Write for it TODAY on your letterhead.

Southern States Equipment Corp.
HAMPTON GEORGIA

Representatives in:

BIRMINGHAM, ALA.	CHICAGO, ILL.	MINNEAPOLIS, MINN.	MEMPHIS, TENN.
LOS ANGELES, CALIF.	EVANSVILLE, IND.	KANSAS CITY, MO.	DALLAS, TEX.
SAN FRANCISCO, CALIF.	VALPARAISO, IND.	ST. LOUIS, MO.	EL PASO, TEX.
DENVER, COLO.	LOUISVILLE, KY.	NEW YORK, N. Y.	HOUSTON, TEX.
WASHINGTON, D. C.	NEW ORLEANS, LA.	CHARLOTTE, N. C.	LUBBOCK, TEX.
JACKSONVILLE, FLA.	SHREVEPORT, LA.	PHILADELPHIA, PA.	SALT LAKE CITY, UTAH
MIAMI, FLA.	BOSTON, MASS.	CHARLESTON, S. C.	SEATTLE, WASH.
ATLANTA, GA.	JACKSON, MICH.	KNOXVILLE, TENN.	MILWAUKEE, WISC.

NEW!
SANGAMO Type MA-25
INDOOR CURRENT TRANSFORMER



Small Transformer-High Impulse Level
for 2400-volt Delta Circuits

Here's a small, inexpensive, completely dependable transformer for your medium voltage metering applications.

The new Sangamo Type MA-25 current transformer provides the high accuracy, high insulation levels, and thermal and mechanical characteristics specified by American Standards Association for dependable service on 2400-volt delta circuits.

This transformer has the same uniform base mounting dimension as the standards for the 600-volt transformer generally used on low voltage circuits. All capacities—from 10 through 800 amperes are physically interchangeable.

Bulletin 501 gives complete information on Sangamo Current Transformers.

SPECIFICATIONS . . .

Accuracy:
Classification 0.3 for burdens B-0.1, B-0.2 and B-0.5.

Insulation:
2.5 KV class test requirements—15 KV at 60 cycles and 45 KV full wave impulse level.

Thermal and Mechanical Ratings:
Continuous thermal current rating factor, 1.0. One-second thermal limit, 70 times rated current. Mechanical short-time limit, 85 times rated current.

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

ECONOMICAL PROTECTION

You can save money-by using the

R&IE

Type MB or MBH RECLOSER for SUBSTATION CIRCUIT PROTECTION

R&IE AUTOMATIC CIRCUIT RECLOSER brings transmission type of service-restoration to distribution centers.

CHECK the FACTS

1 Reduces service costs by preventing unnecessary fuse blowing.
2 Provides full protection to wires and equipment.
3 Greater accuracy through mechanical timing—free from temperature error.
4 Coordinates with (several) secondary fuses.
5 Permits normal fusing for selective clearing of overloads and short circuits.
6 Selects with substation overcurrent relays.
7 Handles high load currents—up to 250 amperes.
8 Provides high interrupting capacity up to 6000 Amps.

TYPE MB AND MBH INTERRUPTING RATINGS

Continuous Duty Rating of the Recloser in Amperes	Type MB 2.1—4.16 Kv	Type MB 4.8 Kv	Type MB 6.9—8.32 Kv	Type MBH 6.9—8.32 Kv	Type MBH 12.0—14.4 Kv
60	2000	1500	1500	1500	1500
100	3000	2500	2500	2500	2000
160	5000	4000	4000	4000	3000
200	6000	5000	4000	4000	3000
250	6000	5000	4000	4000	3000

Full data on Type MB and the new Type MBH—Bulletin 1371

RAILWAY and INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

AFFILIATED WITH THE I-T-E CIRCUIT BREAKER CO., PHILADELPHIA, PA.
IN CANADA — EASTERN POWER DEVICES LIMITED, TORONTO

CONDUCTOR SUPPORTS CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTER

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC RECLOSING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

Here's how the LD fills the bill for a LIGHT-DUTY FOUR WHEEL DRIVE

14,500 lbs. Gross Vehicle Weight

At last there is a *true* four-wheel-drive for the largest segment of the over-all truck field! The LD, born from FWD's unmatched experience in four-wheel-drive development, answers a great demand.

A *True* Four-Wheel-Drive Does *This!*

The only way to gain safety, economy and widened operation with a four-wheel-drive is to have proper distribution of load and power. FWD, alone, delivers those major advantages for this work-range.

The LD Has a *True* Truck Engine!

Only a *real* truck engine can give you peak efficiency for all the work demanding the LD. This efficiency creates on-the-job advantages, longer engine life and attractive savings in gas and oil.

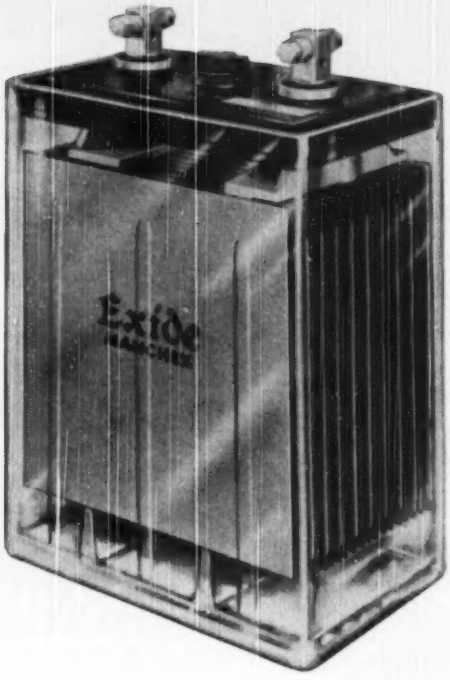
Created for an Entirely New FWD work-range

One of the most important developments in 40 years of FWD leadership! Here is a completely new four-wheel-drive . . . designed to broaden the range of operation in the light-duty truck field. Now you can have a *true* four-wheel-drive to completely fill the needs which *conversions* and conventional trucks have sought to answer. This new model—the LD—fulfills countless requests for an FWD in that broad field.

GET ALL THE FACTS *on the LD! Ask for this folder, "The Story of the LD". See your FWD distributor or write FWD.*

THE FOUR WHEEL DRIVE AUTO CO.
Clintonville, Wisconsin
Canadian Factory: Kitchener, Ont.
World-Wide Sales and Service

Built by the Makers of America's Foremost Heavy-Duty Trucks



Exide-Manchex Batteries

ASSURE DEPENDABLE POWER FOR SWITCHGEAR OPERATIONS

Exide-Manchex Batteries are DIFFERENT in design, construction, performance . . . differences you can count on for dependable battery service day after day . . . and at a saving.

One outstanding feature is the *famous Exide manchester positive plate*, which is used *exclusively* in the Exide-Manchex Battery. Other important features include:

. . . slotted plastic separators, impervious to chemical and electrical reaction.

. . . plastic spacers that maintain perfect plate alignment.

. . . the latest development in molded glass jars.

. . . heavy terminal posts with copper inserts for extra conductivity.

• • •

Combined, these Exide-Manchex features assure you dependable power for positive operation of switchgear.

For an adequate and uninterrupted supply of current for central and sub-station services, use Exide-Manchex Batteries. Wherever used, you can expect trustworthy performance, long battery life and low cost maintenance.

1888...DEPENDABLE BATTERIES FOR 62 YEARS...1950

"Exide" and "Manchex" *Reg. Trade-marks U. S. Pat. Off.*

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • *Exide Batteries of Canada, Limited, Toronto*

oil resistance

chemical resistance

high stability

bakes clear through

low cost

Combines all 5

NEW IRVINGTON #1100 CLEAR INSULATING VARNISH

Specifications:

Dry Dielectric	2000 VPM
Moisture Resistance	Good
Oil Resistance	Excellent
Acid Resistance	Excellent
Alkali Resistance	Good
Heat Resistance	Very Good
Penetration	Excellent
Baume	25° @ 30 deg. C.
Sp. Gr.	0.903 @ 30 deg. C.
Sp. Gr. for use	Optional
Solvent	V. M. & P. Naphtha

Now—just one varnish is all you need for practically all windings. And just one coating normally is enough, when it's a coating of Clear Irvington #1100.

This new insulating varnish penetrates to the deepest coil layers, adhering firmly to the wires, and bonding all into a solid mass. The coating produced is tough, oil-proof and lasting. An internal-curing varnish, it hardens clear through after quick baking. The solvent used—V. M. & P. naphtha—will not attack magnet wire coatings. Both shelf stability and dip tank stability are good.

Irvington #1100 is the latest product of Irvington laboratories. It was developed after extensive research to provide a single varnish for use on all windings except those operating at highest peripheral speeds . . . a top-quality varnish at a moderate price. Standardize on Irvington #1100 and you'll cut your varnish inventory and costs. Samples on request.

IRVINGTON

Varnish & Insulator Co.

Irvington 11, New Jersey

NOW AND DURING THE RECENT PAST it has been our privilege to serve as Engineers-Constructors for a distinguished group of industrial leaders, among them:

BETHLEHEM PACIFIC COAST STEEL CORPORATION
CONSOLIDATED WESTERN STEEL CORPORATION · CONTINENTAL OIL COMPANY
GENERAL MILLS, INC. · GENERAL PETROLEUM CORPORATION · HERCULES POWDER COMPANY
LEVER BROTHERS COMPANY · OWENS-CORNING FIBERGLAS CORPORATION
PACIFIC GAS AND ELECTRIC COMPANY · REVERE COPPER & BRASS INCORPORATED
SHELL CHEMICAL CORPORATION · SOCONY-VACUUM OIL COMPANY, INC.
SOUTHERN CALIFORNIA EDISON COMPANY · THE STANDARD OIL COMPANY OF CALIFORNIA
TENNESSEE GAS TRANSMISSION COMPANY · UNITED STATES BUREAU OF MINES
UTAH POWER & LIGHT COMPANY · THE WESTERN PACIFIC RAILROAD COMPANY

THE GOVERNMENT OF SAUDI ARABIA
ARABIAN AMERICAN OIL COMPANY · BAHREIN PETROLEUM COMPANY, LTD.
KUWAIT OIL COMPANY, LIMITED · MENE GRANDE OIL COMPANY, S. A.
TRANS-ARABIAN PIPE LINE COMPANY · UNITED STATES ARMY ENGINEERS

BECHTEL CORPORATION

LOS ANGELES · **SAN FRANCISCO** · NEW YORK

Associate Organizations

BECHTEL INTERNATIONAL CORPORATION · INTERNATIONAL BECHTEL, INC.
CANADIAN BECHTEL, LTD. · COMPAÑIA BECHTEL, S. A.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

Johnny's "Short Cut" takes 3,000 kilowatts now!

. . . just an old field on the edge of town. A few years ago, Johnny saved ten minutes getting home. Now his favorite short cut proudly displays 400 new homes.

Are you prepared to economically handle this new load?

Sure, it's difficult to predict such future loads . . . BUT you can *plan* for them! For the first time in a good many years, you have a *real* opportunity to rebuild and simplify your system.

This doesn't mean you have to scrap your present equipment. It does mean that replacements and extensions should be made with a *modern system plan* in mind. Its flexibility meets *future* requirements. System planning actually means *less equipment* . . . but *better co-ordinated equipment.*

How can Westinghouse help you in this problem?

We can assist you in your *system planning.* Our engineers have worked with utility engineers throughout the country. Together, we have solved power distribution problems of all kinds and we have learned to *plan* systems and co-ordinate *all* distribution apparatus.

Our complete facilities . . . engineers, calculating boards, service organization . . . are all available to help *you.* May we be of help in your *system planning?* Call your nearest Westinghouse office or write Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa. J-97138

YOUR "Know-How" Put to Work

One of the many ways in which Westinghouse can help you in your problem is to crystallize and formulate the best thinking on *system planning.* Here are three outstanding books to help you:

"Electric Utility Power Distribution Systems", B-3905—explains and classifies typical systems for *all* types of areas.

"Co-ordinated Substations", B-4061—presents a complete standardized line of substations, designed and manufactured to answer any *system* requirement.

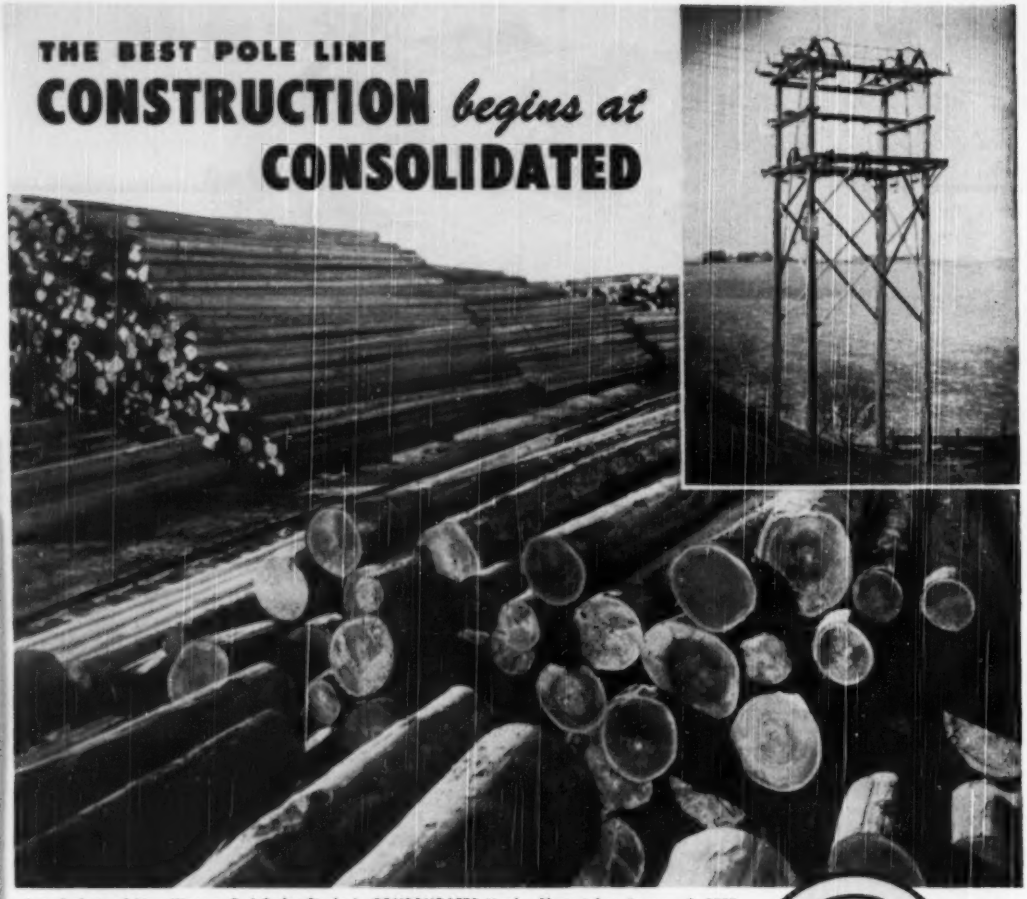
"A-C Secondary Network Systems", B-4002—is the complete story of a system that has saved the utilities at least $175,000,000.

ASK FOR A PRESENTATION OF THIS VALUABLE INFORMATION

Westinghouse

THE BEST POLE LINE

CONSTRUCTION *begins at* CONSOLIDATED



Actual photo of New Western Red Cedar Stocks in CONSOLIDATED Yards. Photo taken January 3, 1950.

YOUR CONSTRUCTION REQUIREMENTS PROMPTLY FILLED with

LIFE-SPAN *treated*

WESTERN RED CEDAR POLES

Whether your approaching construction job is big or one requiring only a carload of poles, your LIFE-SPAN pole needs are ready for prompt delivery from Consolidated.

Straight, strong, lightweight Western Red Cedar treated the LIFE-SPAN way assures you of dependable service up to pole line obsolescence. Built by Nature . . . *perfected* by LIFE-SPAN! Truly the perfect combination in utility poles.

To be sure, to be doubly safe . . . specify LIFE-SPAN Western Red Cedar Poles.

The same LIFE-SPAN treatment is also available for Fir, Western Larch and Lodgepole Pine.

CONSOLIDATED TREATING CO.
MINNEAPOLIS, MINNESOTA

Life Span

For full information write any of the following:

NAUGLE POLE & TIE CORP.
Chicago, Illinois

PAGE & HILL, INC.
Minneapolis, Minnesota
50 Church Street, New York, N. Y.

B. J. CARNEY & CO.
Spokane - Minneapolis

SCHAEFER-HITCHCOCK CO.
Sandpoint, Idaho

ANHYDREX INSULATION + NEOPRENE JACKET = **5-POINT PROTECTION** for **UNDERGROUND NETWORK CABLES**

Anhydrex insulation. Neoprene jacket. Here's a combination that's hard to beat for all-around protection against the hazards that menace underground network cables.

It's exclusive in Simplex-ANHYDREX Cables, and it is their assurance to you of the always-reliable performance that network service demands. More than that, the Anhydrex-Neoprene team keeps down weight and diameter, provides excellent flexibility, does away with the need for duct lubricants, and facilitates jointing, tapping, and terminating, all of which add up to low-cost installation and maintenance.

Check the advantages listed here. See if they don't point to the trouble-free operation you're looking for. And if you would like more-complete information, including specification data, about ANHYDREX Underground Cables, just fill in and return the coupon below.

1. **Moisture Resistance**
   Rigid laboratory testing proves that Anhydrex insulation will not absorb harmful quantities of water. Throughout many years of service in underground and submarine installations no ANHYDREX Cable has ever failed due to water absorption.

2. **Resistance to the Acids, Alkalies, and Corrosive Chemicals Prevalent in Underground Ducts**

3. **Protection Against Oil, Heat and Flame**
   The neoprene jacket will not support combustion and it effectively resists deterioration by oil and heat.

4. **Elimination of Crystallization and Corrosion**
   Needing no outer metallic coverings, ANHYDREX Cables are not subject to electrolysis nor harmed by vibration, stray or secondary currents.

5. **Resistance to Abrasion and Rough Handling**
   The neoprene jacket is unexcelled for toughness; will withstand even more abuse than the best natural rubber compounds.

Simplex WIRES & CABLES

SIMPLEX WIRE & CABLE CO.
79 Sidney St., Cambridge 39, Mass.

SIMPLEX WIRE & CABLE CO.
79 SIDNEY ST., CAMBRIDGE 39, MASS.
GENTLEMEN: PLEASE SEND A COPY OF CATALOG 1013 TO:

NAME _____ TITLE _____
COMPANY _____
STREET _____
CITY _____ STATE _____

How Many

WOULD YOU DESIGN INTO A SINGLE-CIRCUIT UNIT SUBSTATION?

ONE, TWO, THREE, FOUR...? How many would you use for ready access to controls, meters, relays, control transformers and internal secondary connections?

OF COURSE YOU WOULD ARRANGE the equipment functionally . . . safe for meter reading . . . accessible for inspection and testing. Certainly you would use as few doors as possible and still have all equipment easily accessible.

Here's how Allis-Chalmers makes all equipment accessible using only two outside doors!

Equipment is grouped according to its function. Meters, recording instruments, control panel—everything your meter readers and operator will need to examine is located in a safe, dead-front compartment . . . visible after opening the front door!

Current transformers, transformer secondary connections, bus work, internal terminations . . . the "hot side" . . . everything to which your test and maintenance crew will want access is located behind the hinged rear door.

WHAT DOES THIS ARRANGEMENT MEAN TO YOU?

1. ***Greater Accessibility.*** Potential Transformers and Control Power Transformers are *drawout* mounted. Only two outside doors . . . one for dead-front control . . . the other for test and maintenance.

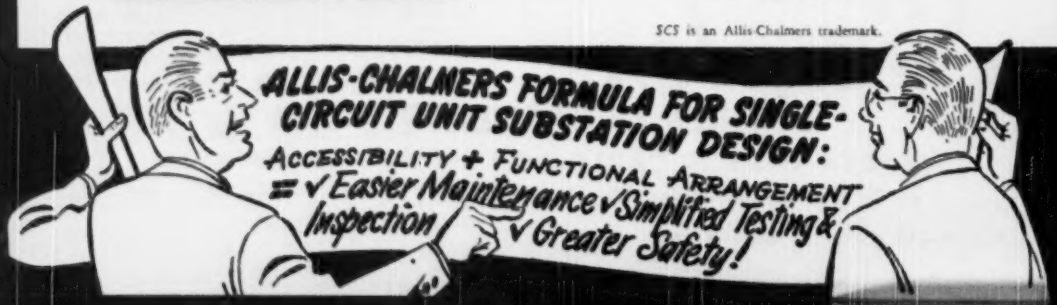
2. ***Simplified Testing and Inspection.*** All components are arranged compactly. Hinged doors instead of removable panels mean less fumbling.

3. ***Greater Safety.*** Operator and meter reader have access only to the dead-front controls. Only maintenance and other authorized personnel can get at the "hot" side.

Allis-Chalmers Unit Substations are modern in appearance and can be fitted quickly into your distribution system. For more information about the ruggedly built, functionally arranged Allis-Chalmers SCS Unit Substation that was designed with your requirements in mind, call your A-C sales office or write direct today.

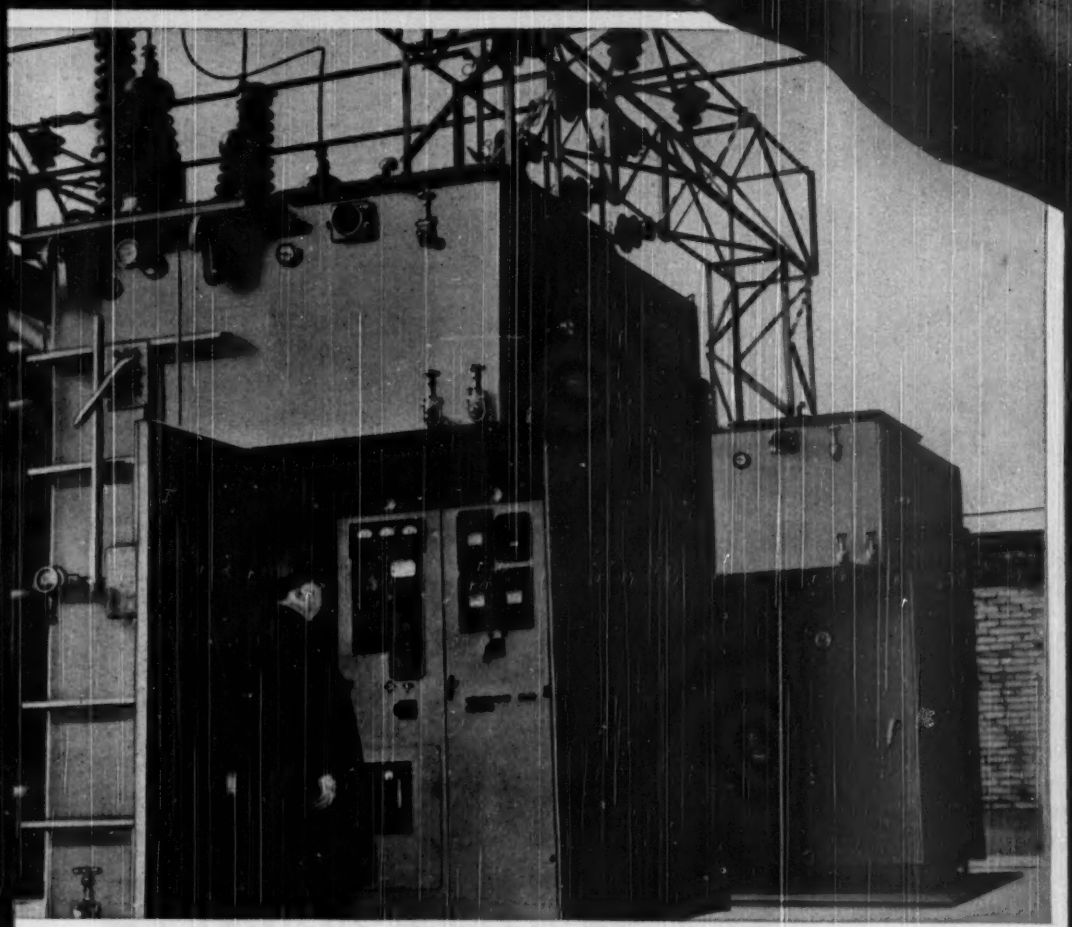
ALLIS-CHALMERS, 932A SO. 70 ST. A-7830
MILWAUKEE, WIS.

SCS is an Allis-Chalmers trademark.


ALLIS-CHALMERS FORMULA FOR SINGLE-CIRCUIT UNIT SUBSTATION DESIGN:
ACCESSIBILITY + FUNCTIONAL ARRANGEMENT = ✓Easier Maintenance ✓Simplified Testing & Inspection ✓Greater Safety!

Doors

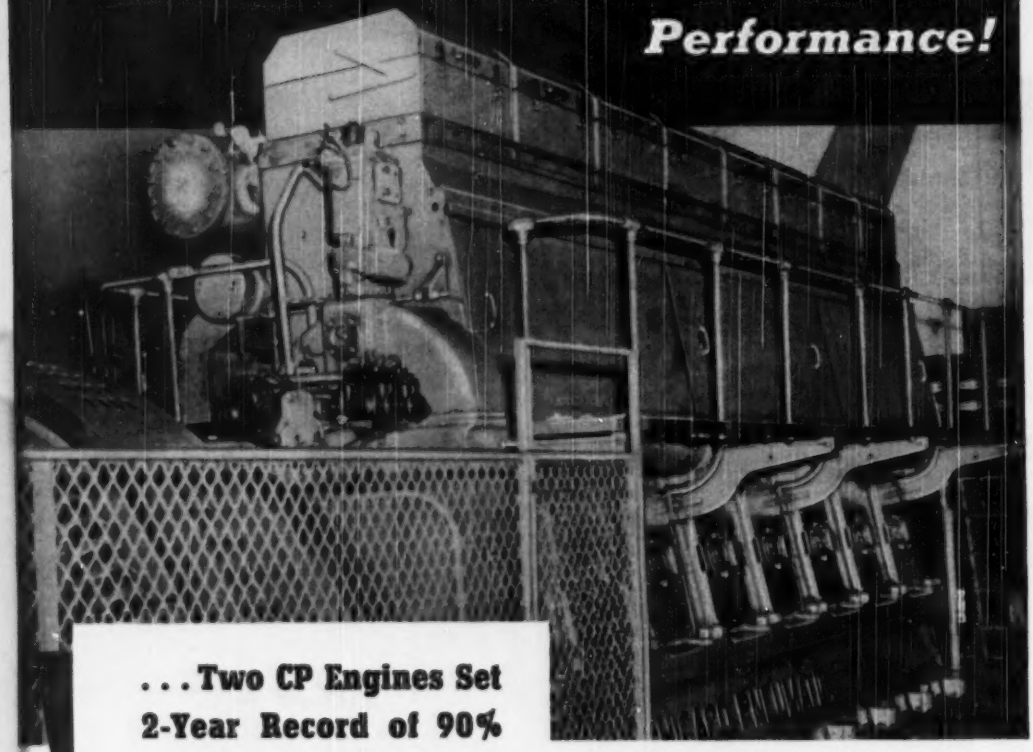
ONE OF A SERIES
IT'S FUNCTIONAL DESIGN THAT COUNTS
IN SINGLE CIRCUIT UNIT SUBSTATIONS



ALLIS-CHALMERS

Pioneers in Load Ratio Control — Originators of 5/8% Step Regulation

Driving ahead to a Power-full Performance!



. . . Two CP Engines Set 2-Year Record of 90% Load factor, 88% Time factor and fuel cost of 3.25 mills per KWH

THE Chicago Pneumatic engine pictured above is one of two 862 CPG Diesel Engines, converted to gas, and installed in a mid-western utility plant. During a two-year period, these CP engines chalked up an outstanding operating record—90% load factor and 88% time factor—generating 8 million kwh, at a power cost of only 3.25 mills per kwh!

This is typical of many other recorded instances where the Chicago Pneumatic tradition of incorporating rugged quality together with advanced design and sound construction features, is upheld by outstanding performance records and longer life in many types of service.

Because the new CP Dual Fuel Engines are instantly convertible from gas to oil, their dual fuel operating abilities offer a decided advantage on dump gas contracts. Write today for Bulletin No. 761 describing the complete line of Chicago Pneumatic Dual Fuel Engines.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

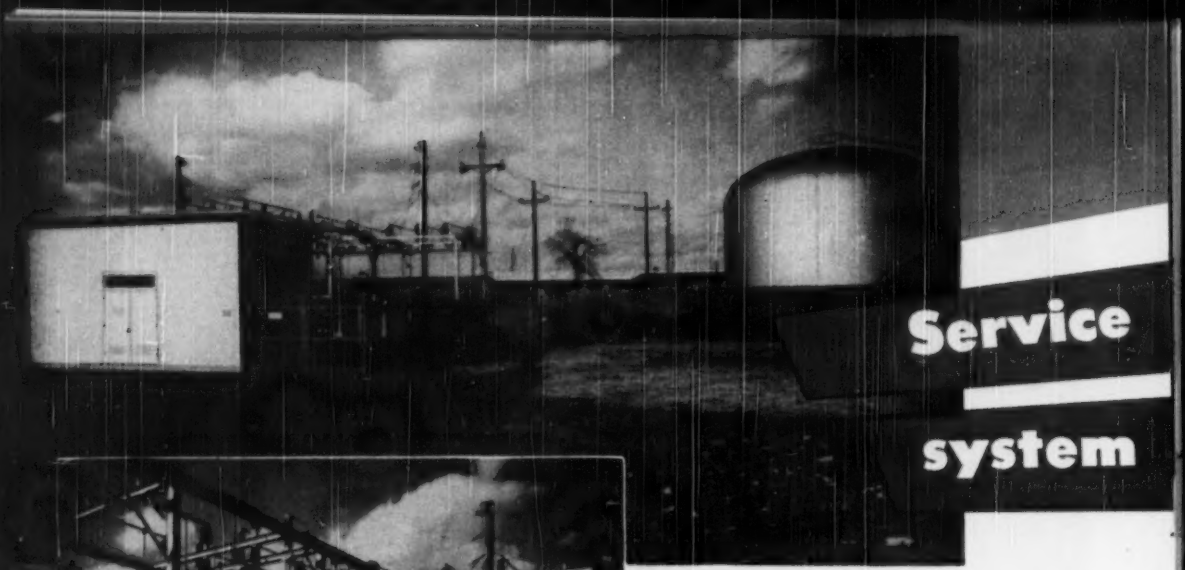
Coming!

Revolutionary development that will

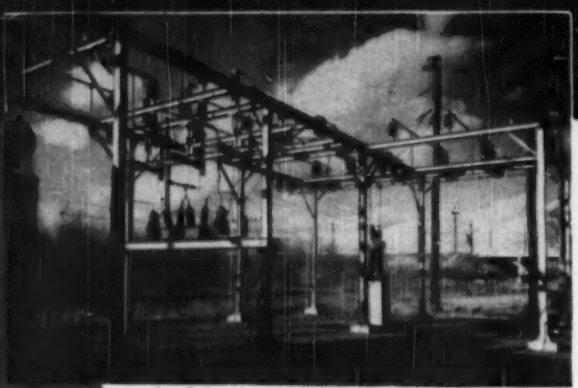
ROCK the INDUSTRY

FEDERAL NOARK

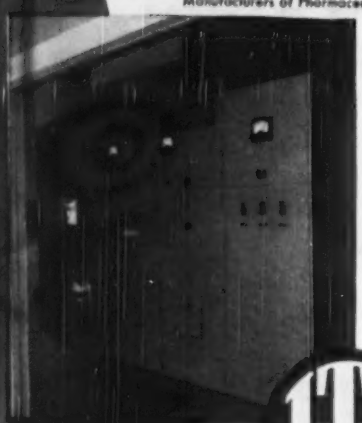
Federal Electric Products Company, 50 Paris Street, Newark 5, N. J.



Service system



Installation photographs through courtesy of Hoffman La Roche, Inc., Nutley, N. J., Manufacturers of Pharmaceuticals.



4000 KVA substation. Incoming voltage 26.4 KV. Outdoor structure layout prepared by R&IE*. Air break switches are type TTR rated 34.5 KV, 600 amperes.

Indoor switchboard is I-T-E type HV. Breakers are rated 1200 amperes continuous, 4160 volts, 150,000 KVA interrupting.

* An I-T-E subsidiary.

Here's another electrical switching and protection problem solved—economically and positively. The I-T-E switchgear installed provides complete protection from point of power entry to individual feeder circuits.

HERE'S WHY:

• **APPLICATION WAS PLANNED TO FIT A SPECIFIC NEED.** No two distribution systems are absolutely alike. I-T-E sales engineers start with an analysis of *your* system and make recommendations and application based on what is required to provide adequate protection.

• **EQUIPMENT IS EFFECTIVE AND DEPENDABLE.** The design of I-T-E components evolves from over 60 years experience in building electrical switching equipment. The confidence in I-T-E gear results from the performance of equipment installed over that period of time.

• **UNITS ARE PROPERLY COORDINATED** I-T-E furnishes an *engineered* assembly. All breakers, relays, instruments, transformers and switches are functionally

I-T-E

For *more dependable* Switchgear

specify I-T-E!

I-T-E Circuit Breaker Company • 19th & Hamilton Streets • Philadelphia 30, Pa.

Power Switching Equipment: Railway & Industrial Engineering Co., Greensburg, Pa.

Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., New York

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • MECHANICAL RECTIFIERS RESISTORS • SPECIAL PRODUCTS

continuity assured with

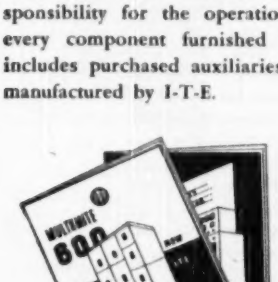
protection by I-T-E

arranged and conform to the recognized codes specifying safe and accepted practice.

• **DESIGN FACILITATES INSPECTION AND MAINTENANCE.** Complete and ready accessibility of all parts makes inspection fast and easy. More inspection per allotted hours of time results in better system maintenance.

• **"PACKAGED DELIVERY" SIMPLIFIES INSTALLATION.** I-T-E switchgear is assembled, tested and shipped as a complete unit or series of units. Only positioning and connecting is required in the field.

• **FULL RESPONSIBILITY ASSUMED.** I-T-E accepts complete responsibility for the operation and performance of every component furnished on your order. This includes purchased auxiliaries as well as equipment manufactured by I-T-E.

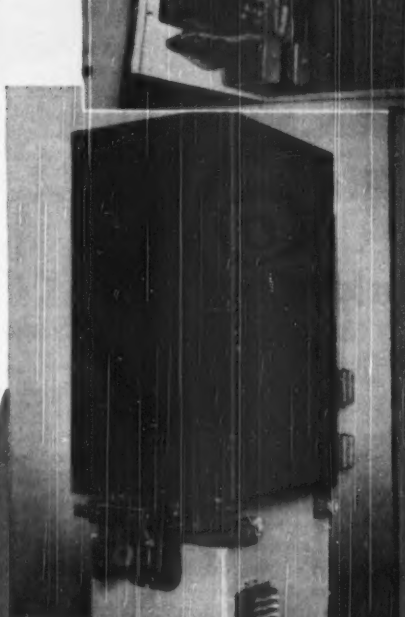


GET THESE HELPFUL BULLETINS

On I-T-E 600 V Switchgear Assemblies: A complete reference guide, containing detailed information on Multumite construction, and helpful facts for specifying and ordering complete switchgear equipments. Ask for Bulletin 6003-D.

On I-T-E 5 KV Assemblies: Describes I-T-E's newest 5 KV Switchgear. Easy-to-read drawings and diagrams supplement photos and text. Ask for Bulletin 7000-A.

Ask your local I-T-E Representative for these bulletins, or write I-T-E General Offices.



CONSTRUCTION OF TYPE HV SWITCHGEAR EMPHASIZES ACCESSIBILITY

Meters and instruments (above) are semi-flush mounted on hinged doors in individual compartments.

They are easily reached for inspection and maintenance.

Circuit breakers of the HV type below are horizontal drawout truck mounted.

No transfer dolly or elevator mechanisms required.

When you think of Electric Heat...

think of Hoskins Chromel*

One quick glance at your industrial heating load will tell you that electric furnaces account for a good and growing part of your total power sales. They represent a highly promotable load potential, too. Because they're safer, cleaner, easier to work with than fuel-fired equipment. They improve working conditions, assure greater productivity, produce better results. They provide more uniform distribution of heat, permit closer control of temperatures, offer greater flexibility of operation. And in addition, too, they give unusually dependable performance over long, hard periods of use thanks to the extreme durability of HOSKINS CHROMEL heating element alloy.

CHROMEL, you know, is the *original* nickel-chromium resistance alloy that *first* made electrical heating practical. It's highly resistant to oxidation because, in use, it forms a thin, dense oxide "skin" which acts as tight, protective armor against further deterioration. It possesses close-to-constant "hot" resistance between 700° and 2000°F., delivers full-rated power throughout its long and useful life. And, backed by over 40 years specialized research, manufacturing and application experience, CHROMEL has been used consistently and with confidence by nearly every manufacturer of industrial, commercial and household electrical heating devices.

So where you're called in on an electrical heating application, you'll do well to recommend the use of HOSKINS CHROMEL heating element alloy. It's your best assurance of giving your customers the continuity of service they want.

Our Catalog M-1 contains useful technical information and helpful application data . . . want a copy?

HOSKINS MANUFACTURING COMPANY

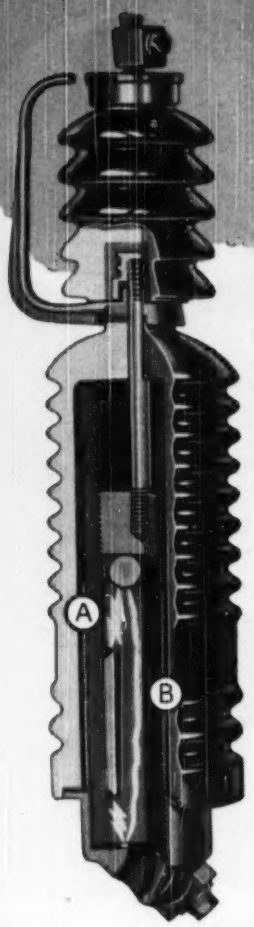
4445 LAWTON AVE. • DETROIT 8, MICHIGAN

NEW YORK • CLEVELAND • CHICAGO

West Coast Representatives in Seattle, San Francisco, Los Angeles
In Canada: Walker Metal Products, Ltd., Walkerville, Ontario

**the original nickel-chromium resistance alloy that first made electrical heating practical*

L-M ANNOUNCES NEW LOW SPARKOVER LEVELS



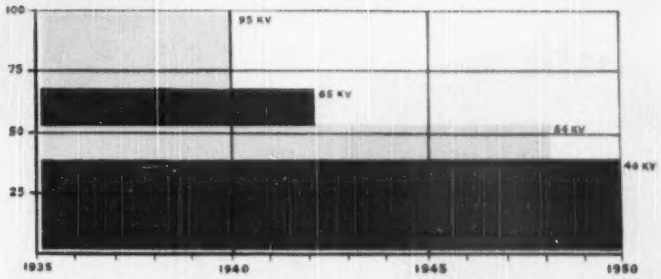


Chart shows reductions in critical impulse sparkover of 9 kv expulsion arresters. Successive improvements give L-M Expulsion Arresters the lowest impulse sparkover in history, the longest life in service.

Cross section of arcing chamber

outstanding improvements achieved by L-M Surge Laboratory research, development

● The extremely low sparkover recently achieved by L-M research answers one of the big objections to the use of Expulsion Arresters. With the new low sparkover voltages, these L-M arresters now give greatly increased protection throughout range of ratings.

Arrester life has also been substantially increased, by means of the L-M arc switching principle. Two electrodes are provided, in the narrow side of a wedge-shaped fibre arcing chamber. Jumping the short gaps at **A**, the arc forms gas that forces it into a long thin arc at **B**—and then almost instantly it is blown completely out of the chamber. The arc does not remain long enough to burn the electrodes and is extinguished so rapidly there is no appreciable erosion of the fibre.

No limit to system capacity on which this expulsion arrester may be used. Meets the NEMA-standard 65,000 amp discharge test with an ample safety margin. Available in 3, 6, 9, 12 and 15 kv sizes, with flat or cross arm mounting hangers. Wet process porcelain housing with rain-shed umbrella design. Strong clamp-type terminals. Heavy external gap electrode, eliminates accidental bending and changing of external gap spacing.

WHO DUNIT . . . AND WHAT!

Here's a thriller for those interested in expulsion arresters—the story of lightning arrester development and performance of the L-M PF-3 Expulsion Arrester. Ask the L-M Field Engineer for a copy of Bulletin LA3, or write Line Material, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

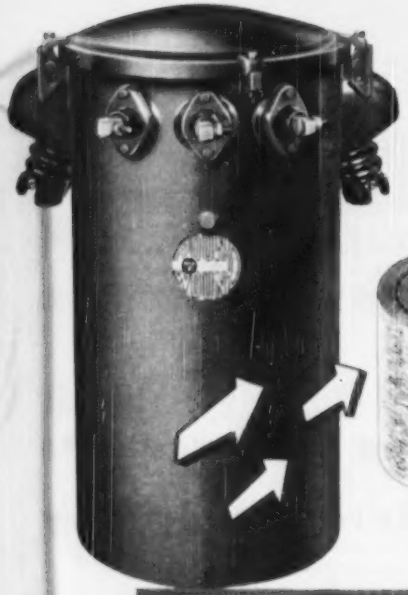
7487

LINE MATERIAL Lightning Arresters

Complete Coordinated Equipment for Distribution Today

Cut failures . . . cut costs . . . with these features of

L-M ROUND-WOUND TRANSFORMERS



High Short-Time Overload Capacity

Stepped core cross section provides oil passages between core and coil; these and the long round coils expose more surface to the oil, assuring better cooling.

High Impulse Strength

Coils are wound round right onto the core—no need to mallet coils into shape. Round coils can be wound tighter with better insulation distribution and improved impregnation, assuring higher average impulse strength.

Balanced Performance

L-M Round-Wound design provides balanced performance characteristics with their many advantages including better regulation, and high short circuit strength.

Quality Craftsmanship

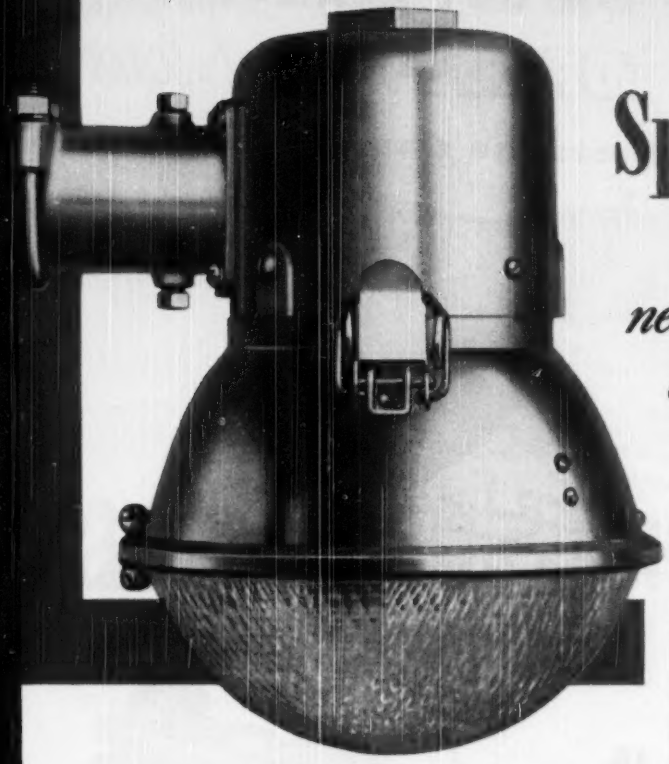
Sealed tank construction, an L-M "first", is one of many quality construction features that assure long life for L-M Round-Wound transformers.

L-M Round-Wound transformers have a record of remarkably few failures—from all causes including lightning. This fact, together with their low operating cost, makes Round-Wounds a most desirable investment for both new construction and replacement of old, high-cost equipment.

Want more information? Ask the L-M Field Engineer, or write Line Material Co., Transformer Division, Zanesville, Ohio.

LINE MATERIAL . . . TRANSFORMERS

Complete Coordinated Equipment for All Distribution Requirements



L-M's new Spherolite, Jr.

for better neighborhood lighting at an economical neighborhood price!

The new Spherolite Jr. offers the many advantages of an enclosed luminaire, with shielded light source and good directional characteristics. Its low original and operating costs make it most suitable for residential areas with narrow streets and wide spacings.

Some Important Features

Narrow beam for increased lighting of streets and shielding of residences.

Concentration of light in the main zone, with maximum intensity of eight times the bare lamp value. Main beam at 78° in vertical provides high visibility at wide spacings.

Choice of IES type II or 4-WAY® light distribution, as shown at left. Refractors easily attached to the specular Alzak reflector with the L-M stainless steel V-Band, which is a positive gasketless seal against bugs, dust, and water. Thus refractors are easily changed in the field, adding flexibility and reducing inventory required for maintenance.

Interchangeability to meet traffic or population growth

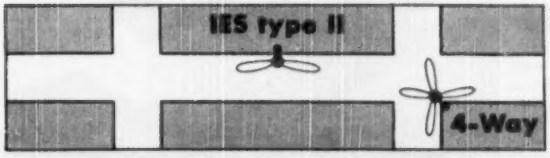
Spherolite Jr. fits the same wide variety of L-M-standardized heads as do L-M's smallest open reflectors and largest enclosed luminaires. Thus changing luminaires usually means simply unlatching one and latching on the replacement—offering a substantial saving in time and material.

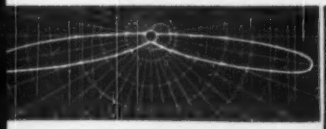
The REFLECTOR-REFRACTOR® assembly illustrated fits any of these: low voltage multiple head; high voltage porcelain head; and, with modified reflector collar, metal series heads up to 5000 volts. The type B head shown is available for either inner or outer wiring, and in either pendent or side mounted style.

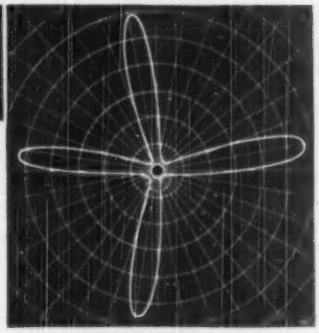
Get complete information on Spherolite Jr. and other equipment and L-M Street Lighting Engineering Service ***from the L-M Field Engineer; or write*** **Line Material Co., Milwaukee 1, Wis.**

® Reg. T. M., Holophane

Two types of light distribution







Choice of two Holophane® refractors which provide either the IES type II pattern shown above, or the 4-Way pattern for intersections at right.

7132

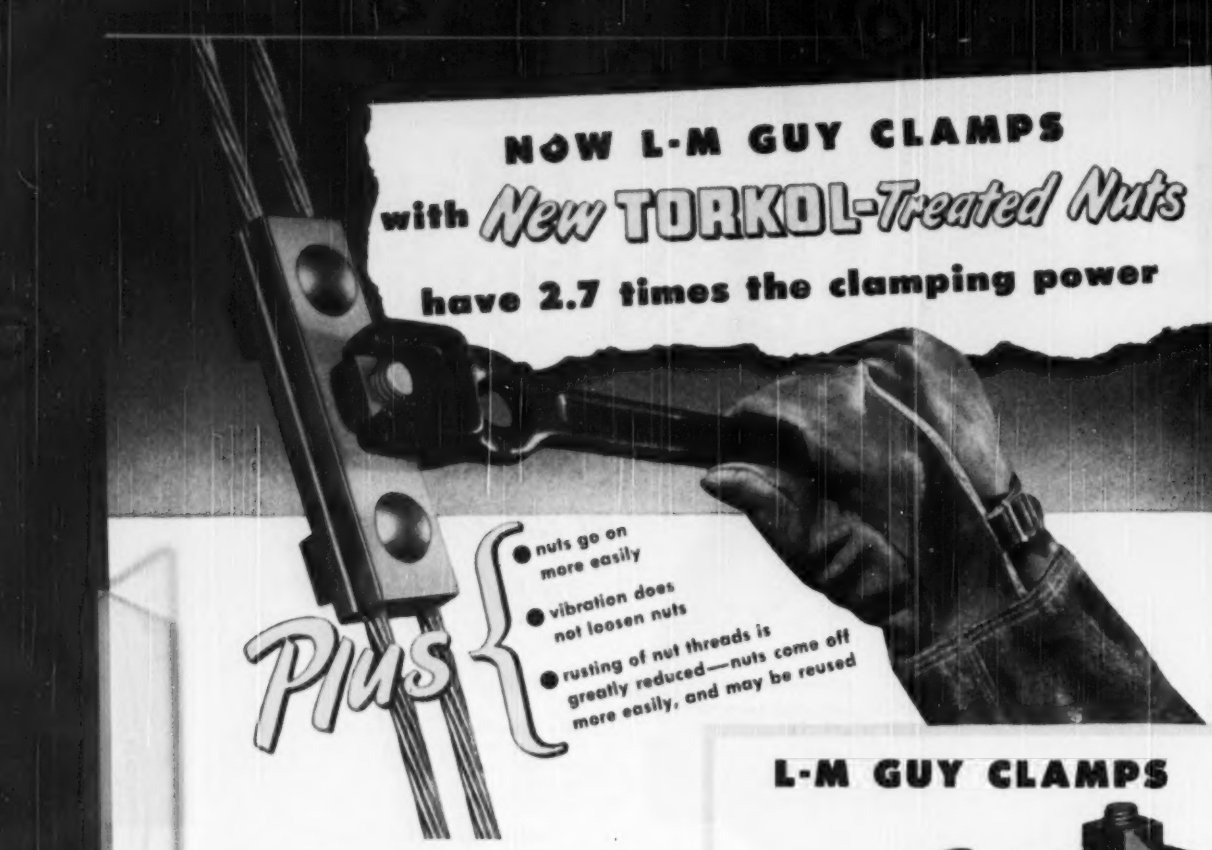
LINE MATERIAL Street Lighting

Complete Coordinated Equipment for All Distribution Requirements

NOW L-M GUY CLAMPS

with *New* TORKOL-*Treated Nuts*

have 2.7 times the clamping power



Plus

- nuts go on more easily
- vibration does not loosen nuts
- rusting of nut threads is greatly reduced—nuts come off more easily, and may be reused

WHAT TORKOL IS AND WHAT IT DOES

TORKOL is an exclusive L-M product applied to the nuts of L-M guy clamps. It is a lubricant that increases the effective clamping power from 2.7 to 3.3 times for any given amount of torque.

Proved by 5 Years of Field Testing . . .

now adopted as standard for these reasons:

TORKOL does not creep or flow to adjacent electrical contacting parts under normal outdoor temperatures; it is not affected by weather changes or rain or sleet.

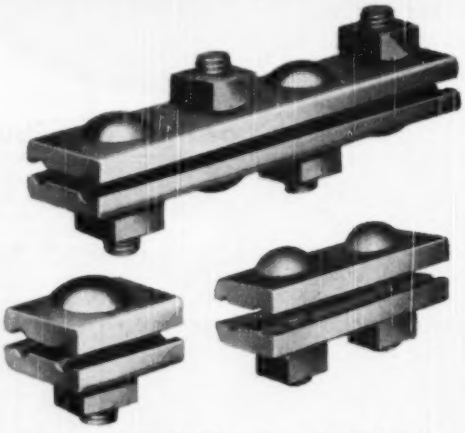
TORKOL is not appreciably displaced when the nut is tightened. Therefore it protects the threads from damage and rusting, permitting easy removal of the nut when desired. And nuts may be reused.

Vibration does not loosen **TORKOL**-treated nuts.

TORKOL is clean, dry. It does not discolor hands, gloves, or clothing. It does not collect dust.

ALL L-M guy clamps are furnished with **high strength bolts.** Nuts only are treated with **TORKOL,** which is colored yellow for identification.

L-M GUY CLAMPS



Heavily galvanized steel, in one to four bolt sizes, from $1\frac{7}{16}$" to 8" long, light or heavy weight, for wires from $\frac{1}{4}$" to $\frac{7}{16}$". Furnished with high strength bolts and **TORKOL**-treated nuts, at **NO extra cost.**

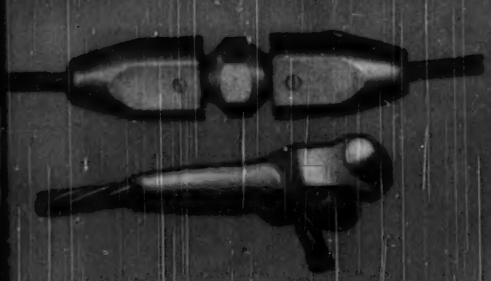
Bolts are opposed as shown. Oval holes in both plates permit inverting the oval shank bolts. Smooth grooves with rounded ends prevent damage to wire.

For details on these and other clamps, and samples of **TORKOL**-treated nuts **ask the L-M Field Engineer or write Line Material Company, Milwaukee 1, Wisconsin.**

7124

LINE MATERIAL Pole Line Hardware

Complete Coordinated Equipment for All Distribution Requirements



L-M FARGO MESSENGER SPLICES AND DEAD ENDS

Both splice and dead end are available in choice of nut type, like the splice shown, for tightening on the ground, or in fully automatic, shown by the dead end, in which a slight cable tension sets the cones automatically. High strength bronze shell, cones, and lock screws. For Copperweld to ¾".

OTHER L-M HARDWARE FOR AERIAL CABLE

L-M provides many useful items, such as the double upset extension bolt, which holds messenger clamps with adequate pole clearance, and the double suspension hanger, which supports messenger during stringing, and grips it permanently after bolts are tightened. Steel, with all parts hot dip galvanized.

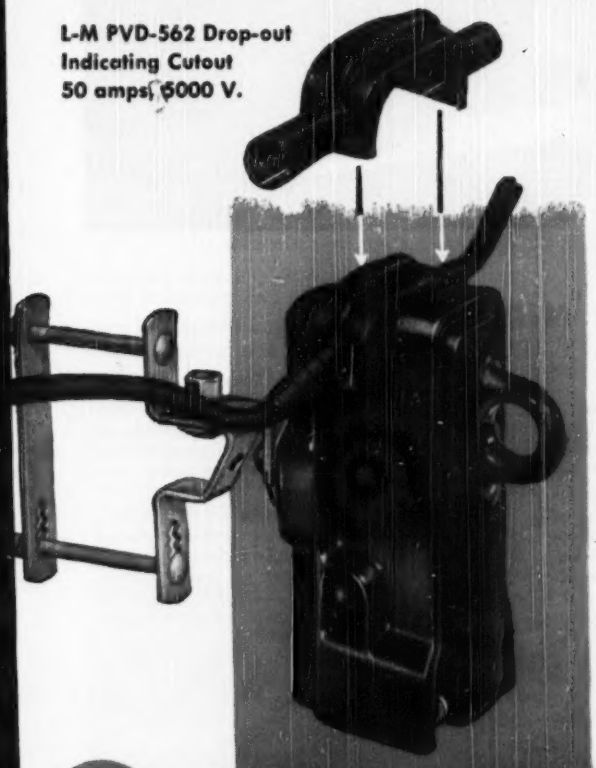
Free!

THIS HANDY GUIDE

Illustrates and describes types of cable, stringing methods, materials, typical installations; 32 pp, indexed. Ask the L-M Field Engineer or write Aerial Cable Materials Division, Line Material Co., Milwaukee 1, Wisconsin.

aerial cable... easy to use with L-M aerial cable materials

L-M PVD-562 Drop-out Indicating Cutout 50 amps, 6000 V.



No "Johnny-come-lately" is L-M in this aerial cable materials business. For years L-M men have worked right alongside of designers, erectors, and users, to test and develop materials that would help simplify the stringing of self-supporting aerial cable, and would help the user enjoy the maximum in service and long life.

In L-M's hardware department, the extensive line of aerial cable materials rates a special division. A few items are shown on this page; many more are described in the bulletin mentioned above. And of course many of L-M's regular hardware and specialty items find application in aerial cable installations.

Discuss your aerial cable problem with the L-M Field Engineer who may give you valuable suggestions; or write Aerial Cable Materials Division, Line Material Company, Milwaukee 1, Wisconsin.

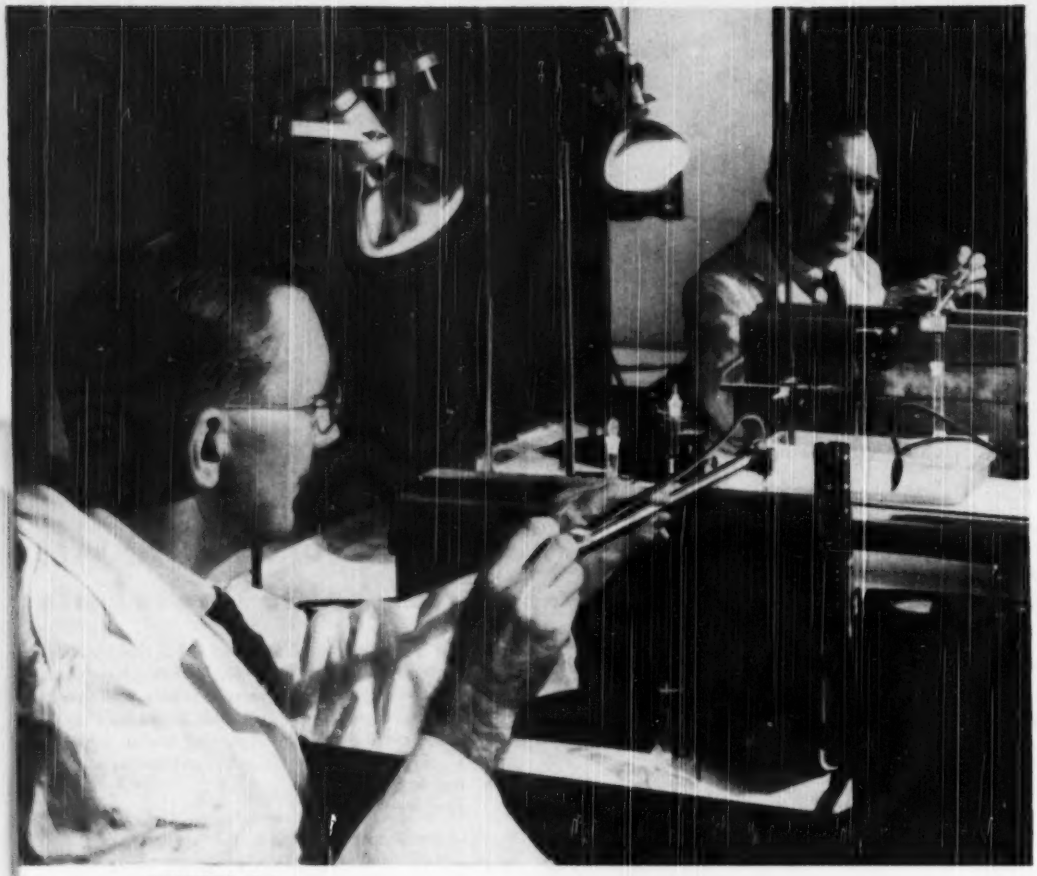
New! L-M aerial cable fuse cutout

The first drop-out cutout designed specially for aerial cable. Same indicating and operating features as the famous L-M PVD-56. But here the conductor runs right through a slot in the top.

You don't cut the cable. Just skin it and drop it into the slot. A copper-jawed clamp grips it firmly without deforming the conductor. The flexible synthetic hood waterproofs the top of the box and protects cut ends of the insulation. Ears of the hood are wrapped around the cable and taped. Makes a neat, fast installation.

LINE MATERIAL... Pole Line Hardware

Complete Coordinated Equipment for All Distribution Requirements



IT'S DONE WITH MIRRORS!

Protected by a wall of lead bricks and using a mirror to guide his instruments, this Bell Laboratories scientist is preparing a solution of a radioactive isotope, for use as a tracer to study materials for your telephone system.

Bombardment by neutrons turns some atoms of many chemical elements into their "radioactive isotopes"; these are unstable and give off radiation which can be detected by a Geiger counter. Chemically a "radioactive isotope" behaves exactly like the original element. Mix the two in a solution or an alloy and they will stay together; when the Geiger counter shows up an isotope, its inactive brother will be there too. Minute amounts beyond the reach of ordinary chemical methods can be detected — often as little as one part in a billion.

The method is used to study the effect of composition on the performance of newly developed germanium transistors — tiny amplifiers which may one day perform many functions which now require vacuum tubes.

It enables Bell scientists to observe the behavior of microscopic impurities which affect the emission of electrons from vacuum tube cathodes. It is of great help in observing wear on relay contacts. And it may develop into a useful tool for measuring the distribution and penetration of preservatives in wood.

Thus, one of science's newest techniques is adopted by Bell Laboratories to make your telephone serve you better today and better still tomorrow.

BELL TELEPHONE LABORATORIES

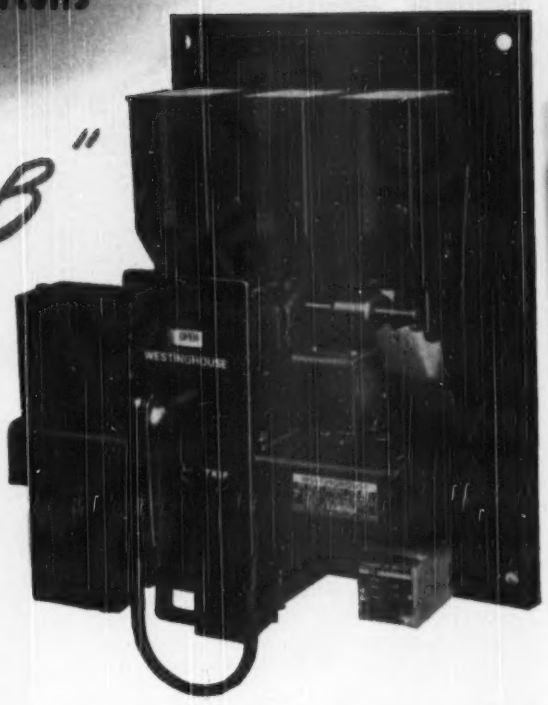
EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

Here's Better Protection for Low-Voltage Circuits

The NEW "DB"



It's a completely new breaker, designed for severe, continuous duty as the protective link between the power source and your productive equipment. Its many features are all planned to provide minimum maintenance throughout a long operating life:

New Overcurrent Tripping Device—Hermetically-sealed overcurrent trip provides time-delay on overloads, plus instantaneous tripping on fault currents. Short time-delay characteristics on fault currents for selective tripping when specified.

All-Metal Mounting Base—Provides a strong, rigid foundation for all parts.

Unit Construction—All attachments and parts easily removed as a unit.

"De-ion" Arc Interruption—For quick arc extinction . . . longer contact life.

Easier Installation—Smaller size . . . easier to work around. Free standing when unmounted.

Long Operating Life—Moving and wearing parts of hardened stainless steel. J-60719

Here's COMPLETE Information

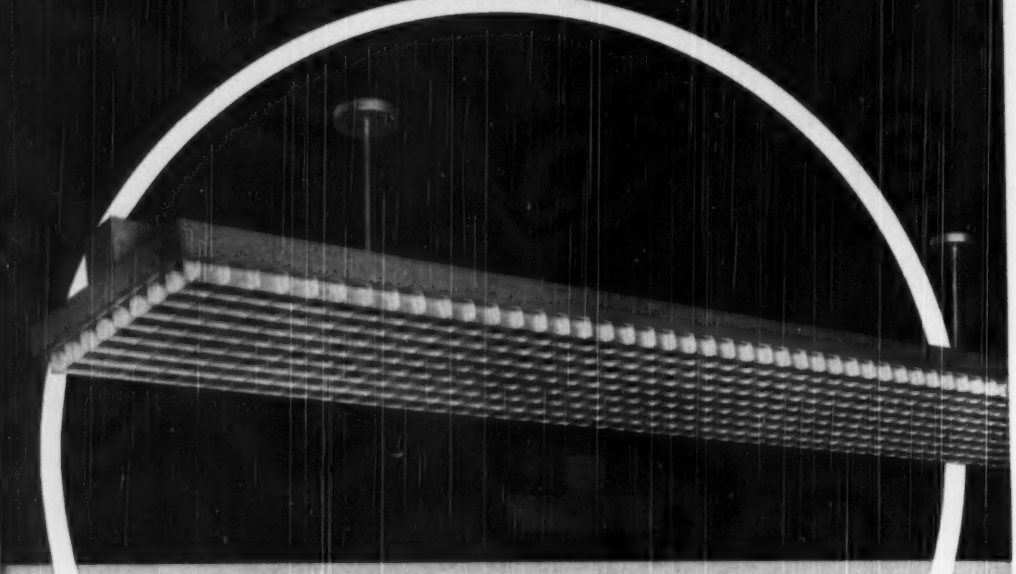
Get answers to your questions, plus complete, detailed information from the new DB Breaker Book. Ask your Westinghouse representative or distributor for your copy of B-4067, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

Westinghouse

"DE-ION" CIRCUIT BREAKERS

New Type DB

Announcing the Miller NEW YORKER



The Miller NEW YORKER is today's foremost in fine Fluorescent lighting fixtures. It's new architectural styling places it in a class by itself — lends a distinction to any commercial interior. Rates high in lighting performance. Has engineered construction features that simplify installation and maintenance, and make for LOW OVERALL COST. In the 8 foot size — in the 4 foot size — with general line or with Slimline fluorescent lamps — or in combination with the Miller spotlight for accent lighting, it is unquestionably today's finest in fluorescent lighting. Write for the NEW YORKER catalog. Miller engineers and distributors are conveniently located to serve you.

"Painting Toward Architecture" — a book about The Miller Company's collection of abstract paintings related to architecture. Leading book stores have it.

THE miller COMPANY

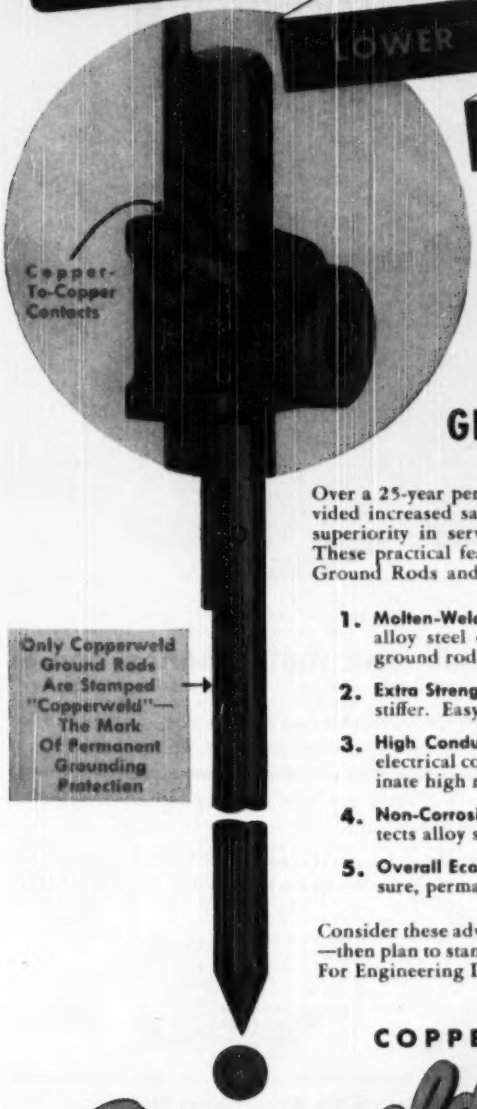
SINCE 1844

ILLUMINATING DIVISION, MERIDEN, CONNECTICUT

FOR GREATER SAFETY . . .

LOWER RESISTANCE . . .

RUST-PROOF PROTECTION



Only Copperweld Ground Rods Are Stamped "Copperweld"—The Mark Of Permanent Grounding Protection

Copperweld
TRADE MARK

GROUND RODS AND CLAMPS

Over a 25-year period, Copperweld* Ground Rods and Clamps have provided increased safety for persons and equipment and have proved their superiority in service wherever driven ground electrodes are required. These practical features are sound reasons why millions of Copperweld Ground Rods and Clamps are giving permanent grounding protection:

1. **Molten-Welded**—Perfect interlocking weld between the copper and alloy steel eliminates possibility of electrolytic action. No other ground rod has this unique Molten-Welded feature.
2. **Extra Strength**—Rugged core of alloy steel is stronger—tougher—stiffer. Easy driving is assured.
3. **High Conductivity**—Thick sheath of pure copper provides high electrical conductance. Copper-to-copper contacts throughout eliminate high resistance connections.
4. **Non-Corrosive**—Rust-proof, thick copper covering permanently protects alloy steel core against corrosion.
5. **Overall Economy**—Long service life with no maintenance costs. Safe, sure, permanent grounding protection for all types of installations.

Consider these advantages in relation to your own grounding requirements—then plan to standardize on ground rods that are stamped "Copperweld." For Engineering Data, write for Bulletin E.D. 375.

MADE BY
COPPERWELD STEEL COMPANY
GLASSPORT, PA.

*Trade Mark

Copperweld
TRADE MARK
GROUND RODS AND CLAMPS

stocked and sold by { HUBBARD AND COMPANY • JOSLYN MFG. & SUPPLY CO.
And All Their Distributors

POWERS line construction and maintenance bodies

This is one of many POWERS Bodies designed specifically for line construction and maintenance work. Readily accessible storage space is provided for tools, fittings, parts, ladders, derrick, rope, wire — in fact everything that's needed for line work. Various models, available for all standard truck chassis, are built to specifications which may be modified to fit your individual requirements.

POWERS Bodies are also available for construction, maintenance, and service operations in all phases of the public utility industry. Write for complete information.

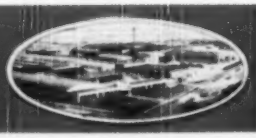
SERIES 25 & 35 — General Service Body. Equipped with shelves, bins, and material hooks. Models for ½, ¾ and 1 ton chassis.

AERIAL LADDER — Rotates 360° at various angles of elevation. In several lengths for mounting on light or heavy duty units.

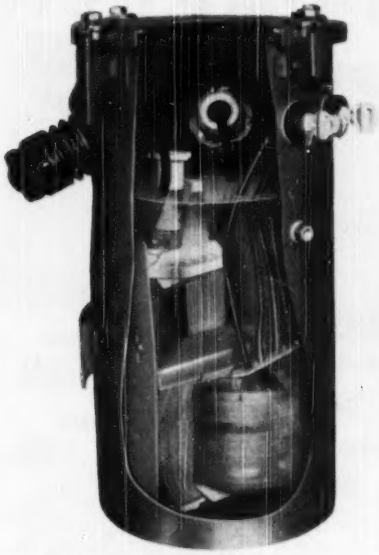
SERIES 300 — Platform Body. Ideal for pole erection and other heavy duty operations in connection with line construction.

ALL-STEEL POWERS Public Utility Bodies

UTILITY BODY DIVISION
McCABE-POWERS AUTO BODY CO.
5900 N. BROADWAY • ST. LOUIS 15, MO.

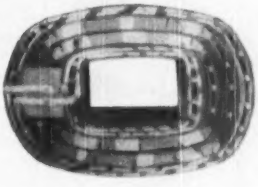


How KUHLMAN builds for lasting service

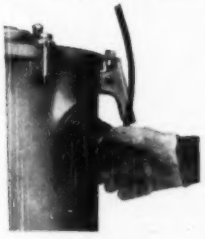


The cutaway above gives graphic proof of the sound, carefully engineered construction of Kuhlman Distribution Transformers. These transformers have been proved "under fire" for over half a century, yet we take nothing for granted — Kuhlman is continually in search of new materials, new methods, new designs, which will mean even greater efficiency, safety and economy for you. A few of the many outstanding features of the Kuhlman Distribution Transformer are pictured and described below.

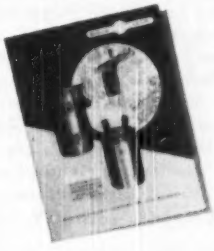
The heart of every Kuhlman Transformer 25 KVA and below, is the famous Kuhlman Bent Iron Core made of cold rolled, oriented silicon steel. It permits the flux path to follow the grain of the steel, resulting in higher permeability, lower hysteresis and saving 25% in weight over cores using hot rolled steel. Core and copper losses are reduced, and exciting current is reduced as much as 75% by utilizing lapped joint construction. In short, the Kuhlman Bent Iron Core is more efficient, smaller, lighter, easier to handle — and *only* Kuhlman has it!



Wide oil ducts. Ample oil circulation is assured by wide oil ducts throughout the windings. The oil itself has been refined to a degree which assures full stability. Transformers are filled with oil under vacuum so that no air is trapped inside. Completely protected coils are dried and coated with high grade phenolic base polymerizing type varnish which bonds the coil into a compact structure.



"Quick-grip" pocket bushings. Pocket type high voltage bushings can be connected as easily as your garden hose. All metallic parts are entirely surrounded by porcelain and by turning the knob at the end, the clamping mechanism opens or closes like a valve, freeing or securing the line connection. No tools necessary!



Write for this new bulletin CS-201 which gives complete facts including specifications on Kuhlman Distribution Transformers, Conventional Type 100 KVA and below. Kuhlman also manufactures a complete line of Power, Dry Type, Street Lighting, and Specialty Transformers. Bulletins available on request.

Sturdy, long-life tanks. All Kuhlman Distribution transformers have sealed tanks fabricated of heavy gauge copper bearing steel and are thoroughly tested for leaks after fabrication. Three coats of paint are put on over a shot blasted surface; one coat of rust inhibitive primer, and two coats of corrosion resistant paint. Tank surfaces have withstood 500 hours of salt spray and weatherometer tests.

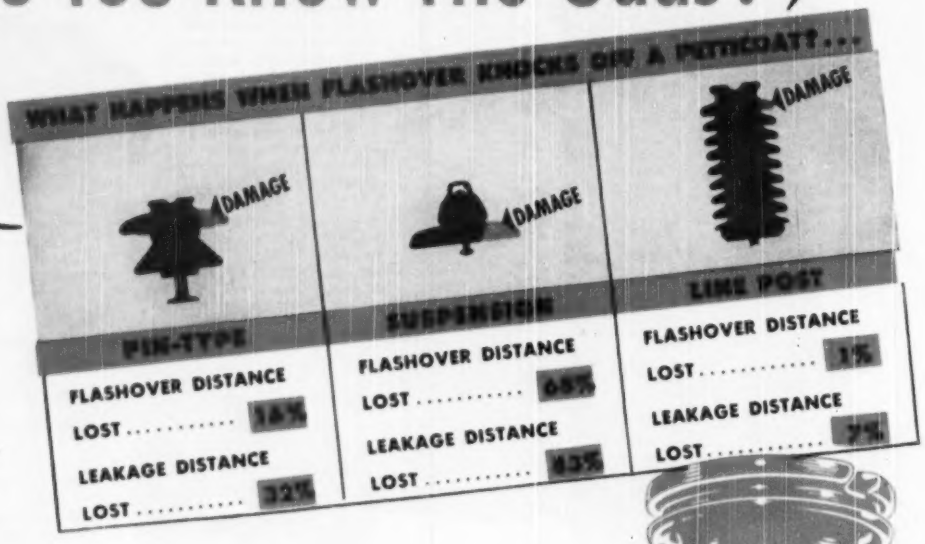
EXPERIENCE COUNTS — THIS IS OUR 56TH YEAR

Kuhlman

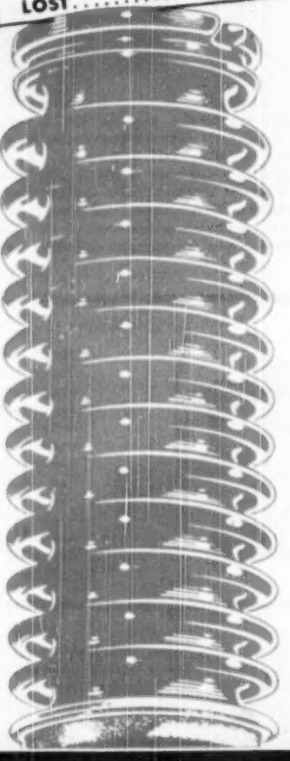
KUHLMAN ELECTRIC COMPANY
BAY CITY, MICHIGAN

Export Representatives: *International Standard Electric Corporation*, **67 Broad St., New York City, N.Y. Cable Address: Microphone, N.Y**

Do You Know The Odds?



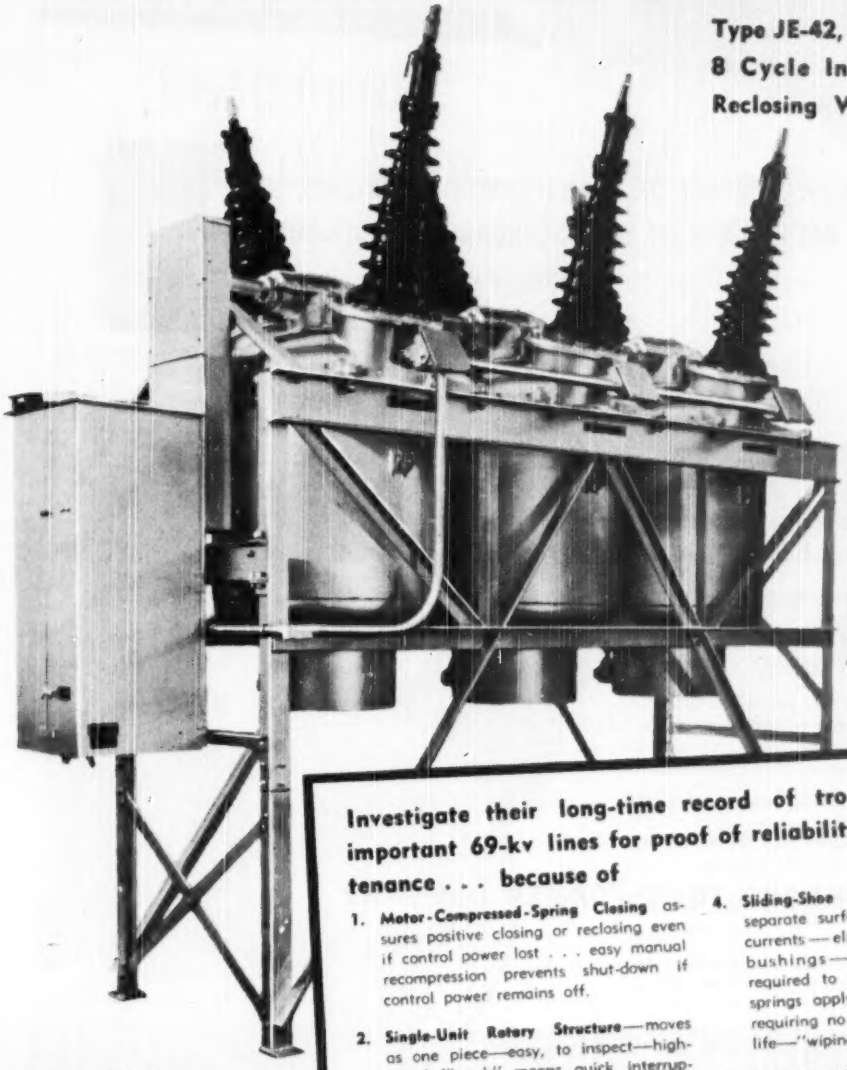
HOW many insulators do *you* have to replace in an average year because of flashover damage alone? Actual records *prove* that the replacement rate on Lapp Line Posts is only 1% to 10% that of other insulators. That's because Lapp Line Posts are built for punishment. Flashover attack that would shatter ordinary insulators breaks off one or two petticoats at the most, leaving Lapp Line Posts' body *intact*, flashover and leakage distances only negligibly decreased, essential efficiency *unimpaired*. Small wonder that service records invariably show that *lines on Lapp Line Posts have fewer outages, require fewer replacements and less maintenance than comparable lines on any other type of insulator*. The odds are all on your side when you build your transmission lines on Lapp Line Posts . . . for maximum performance, maximum economy. Lapp Insulator Co., Inc., LeRoy, N. Y.



PERFORMANCE IS PROOF

Lapp INSULATORS

Pacific Electric BREAKERS Have *The Features You Want*



Type JE-42, Rated 69 kv, 5 or 8 Cycle Interruption. Fast Reclosing Within 20 Cycles.

Ratings Available

Type JE-42E
69 kv 600 amps
1,000,000 interrupting kva

Type JE-42F
69 kv 1200 amps
1,500,000 interrupting kva

Type JE-42G
69 kv 1200 amps
2,500,000 interrupting kva

Conforms to
AIEE and
NEMA Standards

Investigate their long-time record of trouble-free use on important 69-kv lines for proof of reliability and low maintenance . . . because of

1. **Motor-Compressed-Spring Closing** assures positive closing or reclosing even if control power lost . . . easy manual recompression prevents shut-down if control power remains off.
2. **Single-Unit Rotary Structure**—moves as one piece—easy, to inspect—high-speed "break" means quick interruption.
3. **Simple Interrupter**—a glance shows whether or not it is "in order."
4. **Sliding-Shoe Nested Contacts** provide separate surfaces for arcing and load currents—eliminate static stress on bushings—no sensitive adjustment required to fix closed position—leaf springs apply nearly constant pressure requiring no adjustment during contact life—"wiping" assures clean contact.
5. **Low Operating Current** a-c or d-c.
6. **Shipped Assembled**—tested and adjusted.

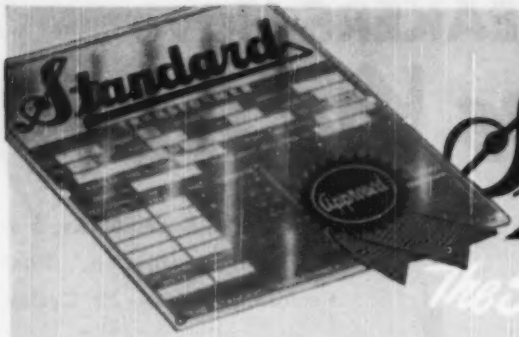
Get All Facts . . .

Call

PACIFIC ELECTRIC MFG. CORPORATION

551 THIRD STREET SAN FRANCISCO 24 CALIFORNIA • P O BOX 449 GARY INDIANA

Other Representatives in Principal Cities



Standard

TRADE MARK ®

The Seal of Proven Quality

OVER A QUARTER CENTURY OF TRANSFORMER EXPERIENCE IS BACK OF THE NAME PLATE ON EACH STANDARD TRANSFORMER

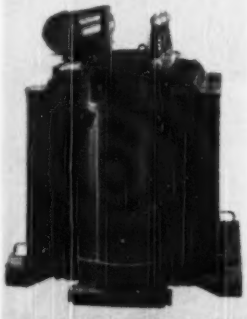
SMALL LOW VOLTAGE DRY TYPE

Veteran transformers, on the job many years and still delivering full performance, are one testimony of STANDARD'S engineering soundness and craftsmen construction. STANDARD'S leadership in contributing improvements to transformer design and building is another. Yet another qualification for your consideration, is STANDARD'S extensive experience in designing and building for special needs. Whether your transformer need is for a low voltage midget or a high voltage giant, STANDARD can best serve your need.

ASKAREL FILLED DISTRIBUTION TYPE

USE STANDARD'S ENGINEERING SERVICE

Our representatives are qualified to discuss transformer needs with you. Save the time of your engineering staff by permitting STANDARD to work out details of transformer application.



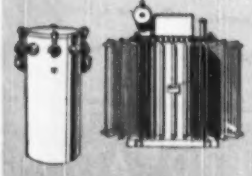
10,000 KVA POWER TRANSFORMER

THE STANDARD TRANSFORMER COMPANY

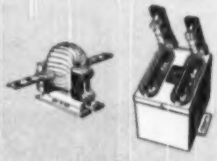
WARREN, OHIO

Representatives in Principal Cities

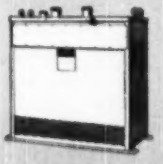
TRANSFORMERS FOR EVERY APPLICATION



Liquid filled (sizes up to 10,000 KVA and 72 KV line.)



Instrument transformers (for use on circuits up to 72,000 volts, inc.)



Dry type (up to 1000 KVA and max. voltage ratings of 4800)

Control transformers (compound filled or open type)

CALL YOUR CENTRAL CONDUIT DISTRIBUTOR WHEN YOU NEED...

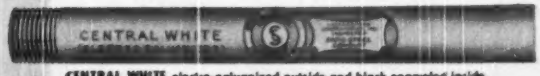
a HELPING HAND

You'll find that your Central Conduit Distributor is *always* ready to give you a helping hand. He's built an organization that has a reputation for service and he's determined to keep it that way.

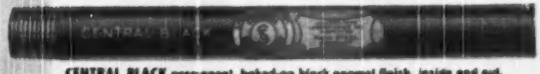
You'll find, too, that your Central Conduit Distributor offers a wide selection of fine products. Take Central Conduit, for example. There are three types to choose from . . . *Cenlaco, Central White* and *Central Black*. Each type measures up to the high standards that have made the name Spang famous for quality.

Whenever you need a helping hand, call your Central Conduit Distributor. You'll like all the products he has for sale and his way of doing business.

CENLACO a hot dipped galvanized and lacquered finish, inside and out.



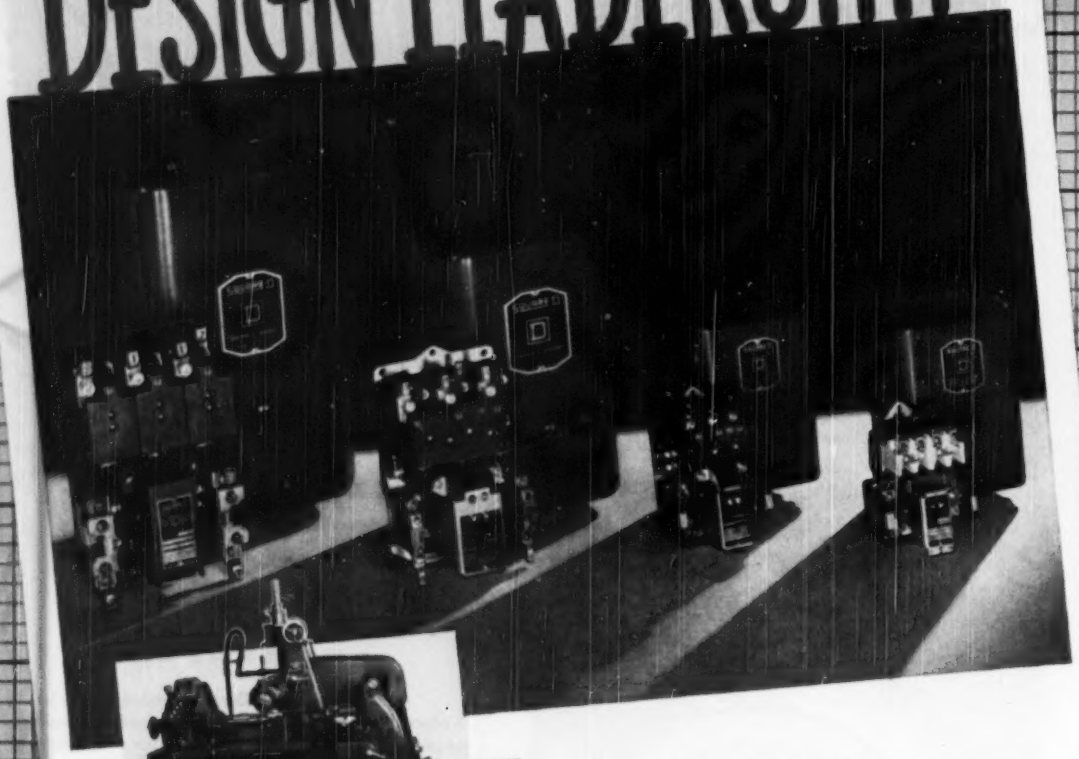
CENTRAL WHITE electro-galvanized outside and black enameled inside.

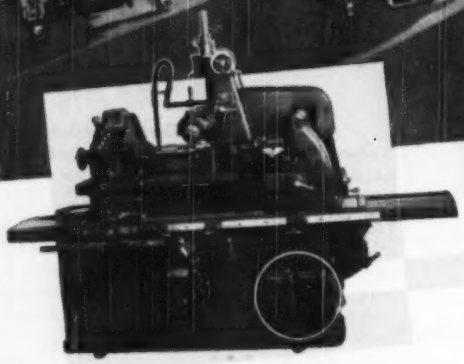


CENTRAL BLACK permanent, baked-on black enamel finish, inside and out.

SPANG-CHALFANT
Division of The National Supply Company
General Sales Office: Grant Building, Pittsburgh, Pa.
District Offices and Sales Representatives in Principal Cities

DESIGN LEADERSHIP





SQUARE D MOTOR STARTERS

SQUARE D's DESIGN LEADERSHIP is reflected in important features: Generous wiring space . . . simple contact change . . . easy coil removal . . . additional electrical interlocks . . . long life . . . NEMA standardization . . . simplified maintenance. These are features which add up to an ever-increasing preference for Square D motor starters.

Write for BULLETIN 8536.

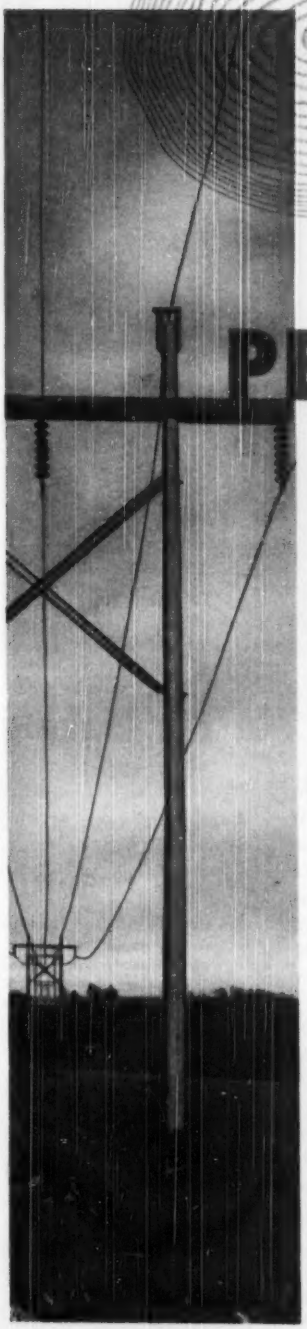
Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

CLEAN,
positive protection for crossarms and poles



PENTA CHLOROPHENOL preservative
(Santophen 20)

Monsanto Penta preservative goes deep into wood and *stays in*. That means long-lasting protection against decay and wood-destroying insects. It means long life for crossarms and poles. Monsanto Penta treatment is *clean*—improves appearance, makes wood easier to work around.

Since penta keeps crossarms, poles, braces and other treated members structurally sound, it means more protection for materials as well as *greater safety for workmen*. Penta does not increase the conductivity of wood.

If you'd like to know more about the advantages of penta protection, write for the booklets: "PENTA . . . the best protection for poles and crossarms" and "PENTA for preserving wood in industrial construction." A copy is yours for the asking. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1758-A South Second Street, St. Louis 4, Missouri.

Santophen: Reg. U. S. Pat. Off.

WHERE IT PAYS TO USE PENTA

Poles
Crossarms
Braces
Platforms and Decking
Loading Docks
Catwalks and Railings
Tool and Machinery Sheds
Trestles and Bridges
Guardrails
Flooring
Sills, Plates, Joists, Rafters and Roofing
Sash and Doors
Ladders and Stairs

MONSANTO
CHEMICALS | PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

MONSANTO CHEMICAL COMPANY
Organic Chemicals Division
1758-A South Second Street, St. Louis 4, Missouri

Please send . . . "PENTA . . . the best protection for poles and crossarms"; . . . "PENTA for preserving wood in industrial construction."

Name ..... *Title* .....

Company .....

Street .....

City ..... *Zone* .... *State* .....

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

This flashover of a horn gap illustrates the kind of power available at the High Power Laboratory . . . power of sufficient magnitude to verify designs for interrupting fault current as high as 10,000,000 kva.

Here's *SURENESS*... in the Making!

Sureness doesn't spring from skillful engineering and quality manufacturing alone. It takes testing, too . . . rigid design testing on a scale equaling the severest kind of service conditions. Fault currents of tremendous magnitude, sub-zero weather, severe icing conditions, searing flashovers . . . these are only a few of the tests given every new Westinghouse design.

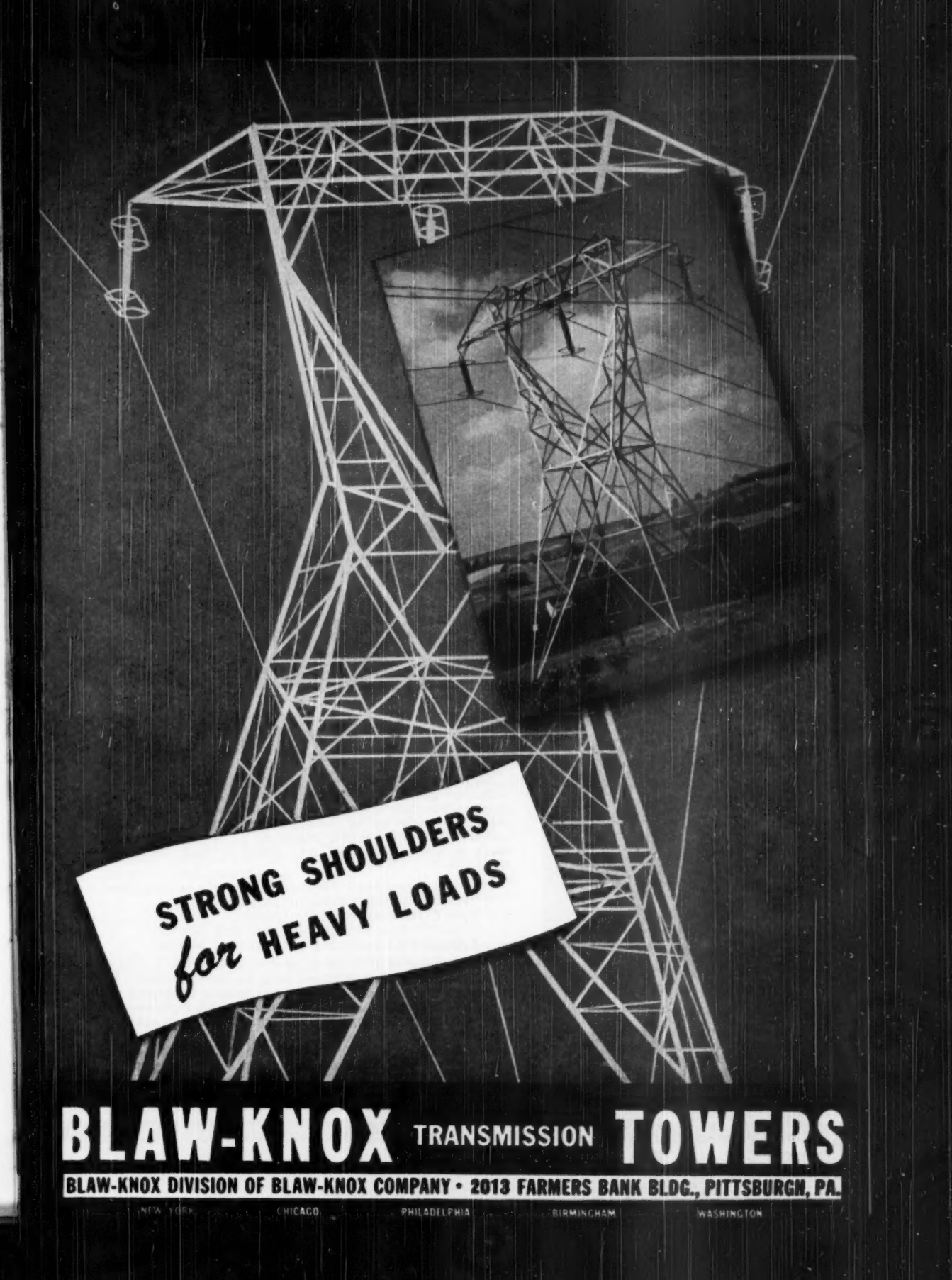
This business of making *sure* . . . of anticipating and duplicating every conceivable service condition, is the work of the Westinghouse High Power Laboratory . . . for 25 years the proving ground for all Westinghouse electrical apparatus. This is where we make *sure* . . . and this sureness is passed along to you. It backs up every Westinghouse label, whether it appears on a tiny switch, a giant circuit breaker or the world's largest lightning arrester. J-60697

SEE FOR YOURSELF!

Booklet B-4383 describes facilities, procedures and actual tests conducted at the Westinghouse High Power Laboratory. Ask your Westinghouse representative for a copy of B-4383, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

Westinghouse

HIGH-POWER LABORATORY



BLAW-KNOX TRANSMISSION TOWERS

BLAW-KNOX DIVISION OF BLAW-KNOX COMPANY • 2013 FARMERS BANK BLDG., PITTSBURGH, PA.

NEW YORK CHICAGO PHILADELPHIA BIRMINGHAM WASHINGTON

NOW A compact desk-

For Wall or Panel Mounting

A Nationwide Distribution Through Electrical Wholesalers

... by CROUSE-

Locations in which the surrounding atmospheres contain sufficient quantities of flammable vapors, gases, or highly combustible dusts to create explosive mixtures are designated as hazardous by the National Electrical Code. Crouse-Hinds Explosion-Proof and Dust-Tight ET Series Telephones were especially designed for service in such hazardous locations.

These explosion-proof telephones are made in four types:

Type ETDA desk telephone, automatic.
Type ETDM desk telephone, manual.
Type ETWA for wall or panel mounting, automatic.
Type ETWM for wall or panel mounting, manual.

All types are built to the high standard of Crouse-Hinds quality; carefully manufactured from the finest materials by highly skilled craftsmen. The cast aluminum housing is engineered to combine maximum strength with light weight, small size, and attractive stream-lining. There is a flame-tight joint between the two sections of the housing. The sections are held together by extra strong heat treated steel socket-head cap screws. A built-in bell is mounted in the base.

The handset on all types is explosion-proof and its 5-foot cord is attached to the housing with a factory-sealed connector.

CONDULETS · TRAFFIC SIGNALS

-type *Explosion-Proof* telephone

-HINDS

The desk telephone has rubber feet to protect the surface on which it rests.

The wall telephone is designed for mounting with the dial up and is equipped with a steel mounting plate. The base is reversible so the conduit hub can be at the top or at the bottom. The base also has a hub on the back for use if the conduit enters from the rear.

Both the desk and wall telephones should be connected to the Type ETS Line Switch, which can be mounted at any convenient location near the telephone.

In noisy locations where the built-in bell would be inadequate, separate loud ringing bells or horn signals can be installed.

Complete listings of explosion-proof telephones and accessories are in Crouse-Hinds Condulet Catalog.

Type ETH
High Power
Horn Signal
Double Projector

Type ETS
Line Switch

Type ETF
Extension Telephone
with Line Switch

Type ETR
Loud Ringing
Bell Signal

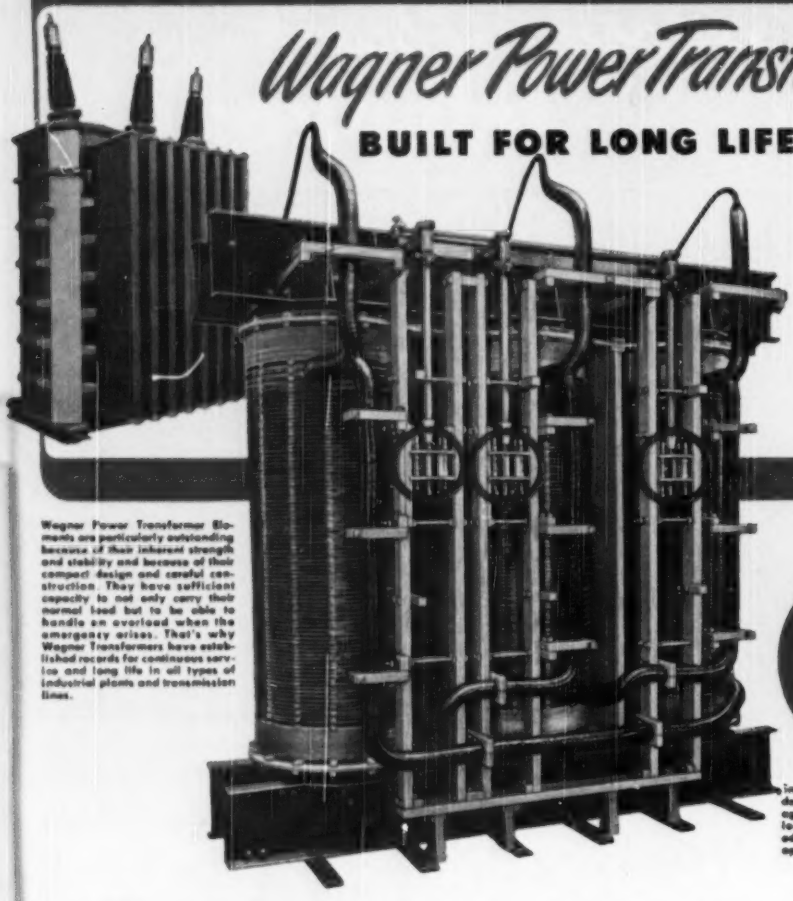
CROUSE-HINDS COMPANY
Syracuse 1, N. Y.

Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Indianapolis — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia Pittsburgh — Portland, Ore. — San Francisco — Seattle — St. Louis — Washington. Resident Representatives: Albany — Atlanta — Baltimore — Charlotte — New Orleans — Richmond, Va. — Salt Lake City
CROUSE-HINDS COMPANY OF CANADA, LTD. TORONTO, ONT.

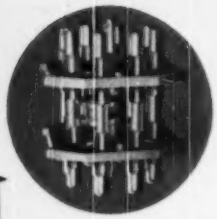
AIRPORT LIGHTING · FLOODLIGHTS

Wagner Power Transformers

BUILT FOR LONG LIFE SERVICE



Wagner Power Transformer Elements are particularly outstanding because of their inherent strength and stability and because of their compact design and careful construction. They have sufficient capacity to not only carry their normal load but to be able to handle an overload when the emergency arises. That's why Wagner Transformers have established records for continuous service and long life in all types of industrial plants and transmission lines.



Inner acting rotary type tap changers, designed to permit changing the voltage ratio quickly and effectively, are located near the taps and are connected for gang operation from a single operating handle outside the tank.

Any transformer you buy comes to you with a number of specified, generally standardized, accessories. Your primary requirement in a transformer, however, is the safe transformation of electrical power upon which you can rely. Whether this need is satisfied depends entirely upon the materials used and upon the design and construction of the transformer element inside the tank.

Wagner Power Transformers will meet your primary requirements because they are liberally designed and built using carefully controlled construction methods, highest quality material, and are rigidly inspected and tested.

Field performance is the real proof — Our service records date back to the early 1900's and prove that Wagner Power Transformers give many years of dependable, economical service.

Users of power transformers will find it to their interest to consult Wagner on their next transformer installation. Twenty-nine branch offices, located in principal cities and manned by trained field engineers, are at your service for consultation on your transformer problems and offer speedy, nation-wide service facilities. Bulletins TU-180 and TU-181 give information on the complete line of Wagner Power and Distribution Transformers.

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

Wagner Electric Corporation
EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

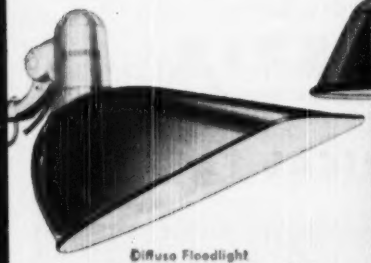
BRANCHES IN 29 PRINCIPAL CITIES

TU-1

MORE FOR EVERY LIGHTING DOLLAR!

Industrialite High Mounting Fixture
For use in railroad yards and round houses, steel mills, foundries—hundreds of industrial installations.

Separable Standard Dome Reflector
Hood is easily detached for cleaning or servicing without disconnecting wires. Weatherproof.



Diffuse Floodlight
For even illumination of service stations, athletic fields, tennis courts, parking spaces, etc. Available for Pole, Bracket or Cross arm mounting.

Vented Explosion-Proof Fixture
Ruggedly built of tough, malleable iron, this Fixture provides safe, superior illumination for hazardous locations.

Type EFU Explosion-Proof Fixture
Up-to-the-minute version of the first Fluorescent Lighting Fixture ever to be developed. Can be hung horizontally or at 45-degree angle.

APPLETON LIGHTING EQUIPMENT

Appleton Lighting Equipment is scientifically designed to provide maximum lighting efficiency at minimum installation, service and operating expense.

The manufacture of Appleton Fixtures is quality controlled from raw materials to finished product. Metal parts of reflector are made of pure ingot iron—tough, long-wearing metal that is ruggedly corrosion-resistant. Vitreous-fired porcelain enamel finish provides maximum reflecting efficiency.

Including hundreds of types and sizes, the Appleton Line contains a fixture to fit virtually every lighting requirement, whether indoors or out. Sectionalized construction of all types assures quick, easy servicing. Get the most from your lighting dollar. Specify Appleton, STANDARD FOR BETTER LIGHTING.

Write for complete Catalog information.

SOLD THROUGH ELECTRICAL WHOLESALERS

APPLETON ELECTRIC COMPANY

1701 WELLINGTON AVENUE • CHICAGO 13, ILLINOIS

Branch Offices: NEW YORK, 50 Church Street • DETROIT, 3049 E. Grand Blvd. CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Minna Street ST. LOUIS, 420 Frisco Bldg. • LOS ANGELES, 100 North Santa Fe Avenue ATLANTA, 724 Boulevard, N. E. • BIRMINGHAM, 429 Brown-Marx Bldg. MINNEAPOLIS, 305 Fifth St., S. • PITTSBURGH, 414 Bessemer Bldg. BALTIMORE, 100 East Pleasant Street • BOSTON, 10 High Street • DENVER, 1921 Blake Street • PHILADELPHIA, 1017 Cherry Street.

Resident Representatives: Cincinnati, Dallas, Houston, Indianapolis, Kansas City, Milwaukee, Seattle • *Export Representatives:* International Standard Electric Corp., 67 Broad St., New York 4, N.Y.

APPLETON

CONDUIT FITTINGS • LIGHTING EQUIPMENT • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

INTRODUCING

DUTCH BRAND PLASTIX

ELECTRICAL TAPE

packaged 5 rolls to usable container!

MADE BY SPECIALISTS IN THE MANUFACTURE OF ELECTRICAL TAPES FOR FORTY YEARS

DUTCH BRAND PLASTIX ELECTRICAL TAPE is superthin in construction but high in dielectric resistance; it is used in those many places where space is limited. It stretches and conforms readily to irregular surfaces... stands up under severest conditions... resists water, oil, acids, alkalies and corrosive chemicals.

DUTCH BRAND PLASTIX ELECTRICAL TAPE is the result of careful study and research and meets the recognized high quality standards established by all other DUTCH BRAND electrical tapes.

For complete satisfaction order DUTCH BRAND PLASTIX ELECTRICAL TAPE by name.

FEATURES THESE MANY OUTSTANDING QUALITIES

TEARS READILY... **in spite of its strength and stretch.**

CONFORMS TO IRREGULAR SURFACES... **superthin, great flexibility and stretch make excellent conformity.**

RESISTS WEATHER... **rain and rough weather do not affect it... favorably withstands relatively high or low temperatures.**

RESISTS ACIDS, ALKALIES, CORROSION ... **wherever present... in chemical plants, around machinery, etc.**

EXTRA-HIGH DIELECTRIC RESISTANCE... **a single thickness resists 8000 volts which is greater than 1000 volts per mill of thickness.**

EXCELLENT ADHESION... **the quality of the adhesive and the even coating assure excellent adhesion.**

TENSILE STRENGTH... **it is strong... has ample strength for all types of applications.**

MADE WITH "KNOW HOW" AND UNDERSTANDING OF ELECTRICAL REQUIREMENTS

SEND FOR SAMPLE ROLL!

DUTCH BRAND

VAN CLEEF BROS. INC.

Manufacturers... Rubber Products... Est. 1910

CHICAGO 19, U. S. A.

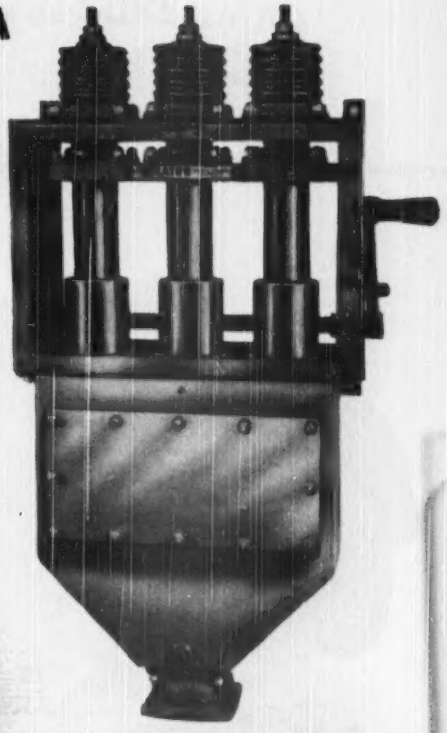
YOU CAN DO IT BETTER WITH A

Cable Isolator

A Cable distribution system represents a considerable portion of plant investment. However it can only be as good as the cable terminating devices used.

The "Three E" CABLE ISOLATOR has proven itself a most efficient device for the protection and isolation of cable ends. Listed herewith are some of its superior features.

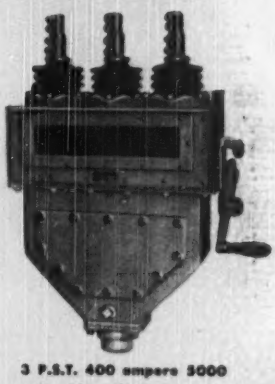
1. A disconnecting and terminating device in one integral piece of equipment. Saves space and materials.
2. All circuit leads are closed or open in one operation and held open indefinitely without the use of auxiliary equipment.
3. By use of a remote control mechanism operation can be made from base of supporting structure or at other remote point.
4. All live parts are shielded.
5. Provides visible proof that circuit is open.
6. When AIR INTERRUPTER type is used, cable charging current and considerable load current can be opened. The interrupter units are of the Modern dry type using no oil or other inflammable liquids.
7. Welded steel pothead body allows for expansion or contraction of insulating compound in manner not possible with cast iron bodies.



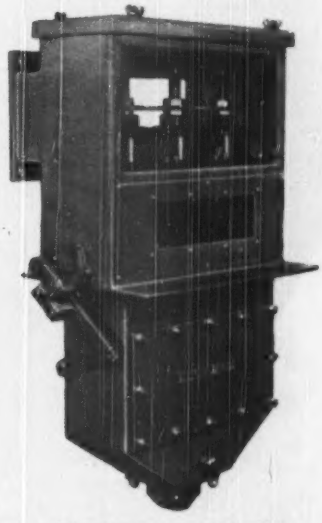
3 P.S.T. 200 ampere 15000 volt indoor disconnect type.

Investigate the CABLE ISOLATOR the next time you have a cable terminating job. You will like its compactness, safety first features and general simplicity.

- **Write for descriptive bulletins.**
  No. 138 for air interrupter type.
  No. 140 for disconnect type.



3 P.S.T. 400 ampere 5000 volt outdoor disconnect type.



3 P.S.T. 400 ampere 5000 volt outdoor air interrupter type with flanged throat for mounting on transformer.

THREE E — ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK, ILLINOIS

WESTINGHOUSE
Westinghouse "CSP"
TRANSFORMERS

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

For emergency only...

Pull!

When the breaker trips after repeated red light warnings, and you must get back in service without delay . . . *pull the Emergency Control!*

Save costly overtime.

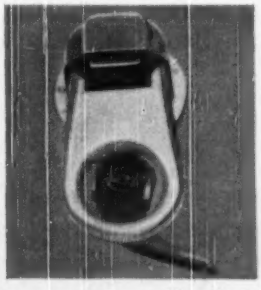
Avoid change-outs under adverse conditions.

Emergency Control adjusts the "CSP"® breaker to allow greater overload before tripping. It permits regular crews to schedule change-outs at convenience.

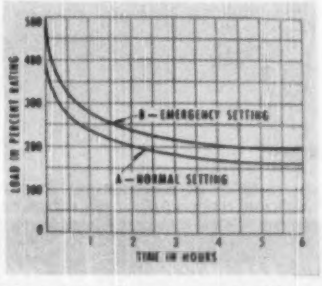
Even with Emergency Control in operation, "CSP" Transformers have full lightning and short-circuit protection.

Now standard equipment on all Westinghouse "CSP" Transformers with signal lights, 5 through 100 kva, Emergency Control gives greater assurance of service continuity . . . lets you be sure of maintaining service. Contact your Westinghouse representative or write for Booklet B-4249. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70551

Emergency Control handle, secured in normal operating position with a standard meter seal.



Emergency Control handle in emergency position. This sets breaker for greater overloads.



Typical breaker trip curves, illustrating increased overloads sustained with Emergency Control.

NO DOUBT you've experienced it—the real pleasure in grasping a problem, wrestling with it a bit, and then coming up with a solution. The unusual electrical insulation part shown above is a good example. It illustrates the kind of problem that could arise in your plant—and wind up in our "Imagination Department."

To make the part, the Manufacturer wanted plenty of structural strength, dielectric strength, light weight, and resistance to moisture, heat, and corrosion —all wrapped up in a material that was easy to machine. Continental-Diamond studied the problem, used a little imagination, and came up with *two* different plastics — Laminated Dilecto Tubing for the threaded section, and Celoron for the molded, macerated ring.

It's a good example of imagination at work—but it's a better example of how you, too, can depend upon C-D to engineer the right plastic for your needs. For C-D has no "axe to grind." We can recommend from five basic plastics subdivided into a remarkably wide range of grades and combinations of grades to meet your requirements. For complete engineering help or fast delivery of any grade, call your nearest C-D office, any time.

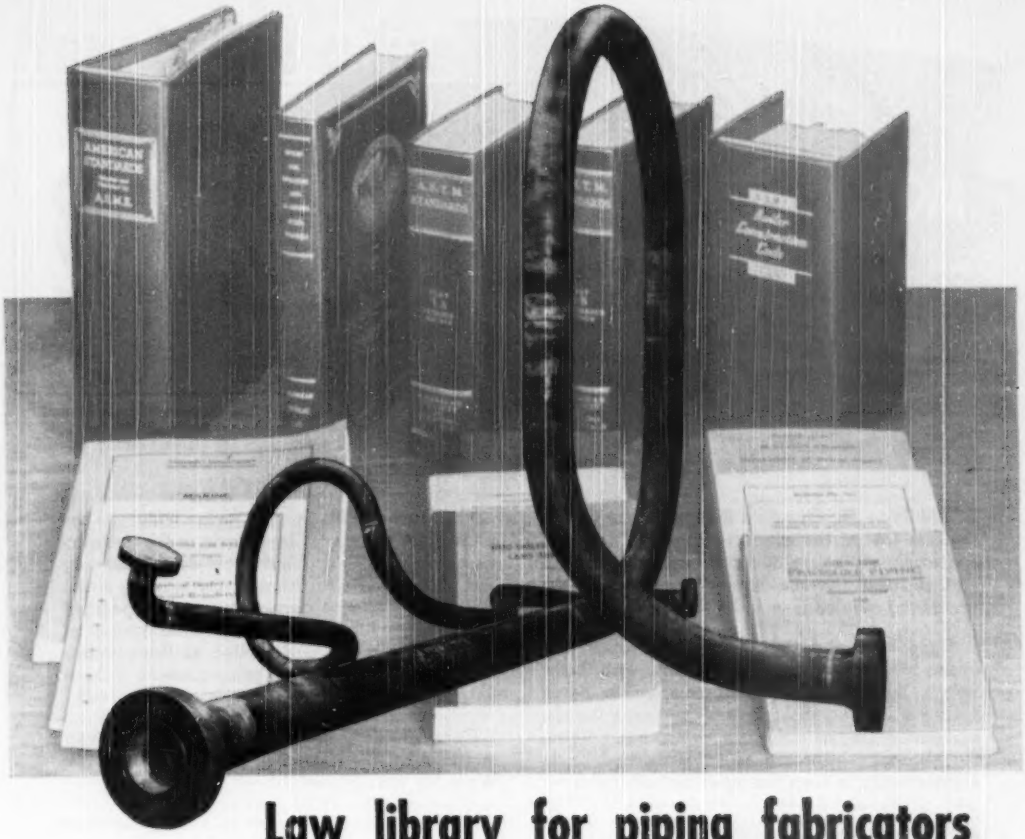
DE-2-50

CELORON (Molded High-Strength Plastic)
MICABOND (Bonded Mica Splittings)
DIAMOND FIBRE (Vulcanized Fibre)
VULCOID (Resin Impregnated Fibre)
DILECTO (Laminated Thermosetting Plastic)

BRANCH OFFICES: NEW YORK 17 • CLEVELAND 14 • CHICAGO 11 • SPARTANBURG, S. C. • SALES OFFICES IN PRINCIPAL CITIES.
WEST COAST REPRESENTATIVE: MARWOOD LTD., SAN FRANCISCO 3 • IN CANADA: DIAMOND STATE FIBRE CO. OF CANADA, LTD., TORONTO 8

Continental Diamond FIBRE COMPANY

Established 1895 Manufacturers of Laminated Plastics since 1911 — NEWARK 15 DELAWARE



Law library for piping fabricators

THE safety of your employees, the welfare of the community and a major investment can depend on a single piece of prefabricated piping. That's what piping codes are for . . . state, national, association and insurance codes. You don't have to know these codes because Grinnell engineers know the "law" intimately, check and cross-check with these codes at every step from preparation of detailed drawings and specifications right through bending, welding, stress relieving, heat treating, testing, final inspection, assembly and test runs.

That's just one of the many advantages of having a piping system prefabricated by Grinnell.

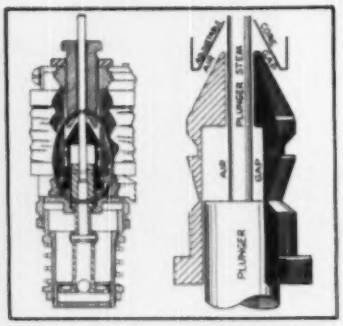
The complete "package" includes interpretative engineering, metallurgical research, compliance with code requirements, manufacturing drawings and specifications, production schedules, purchase of materials, specialized facilities, skilled personnel, control of quality and rigid inspection.

You get this complete package from a Grinnell prefabricated piping plant on schedule, ready for field erection, meeting all code requirements and at a real economy.

100th ANNIVERSARY — WHEREVER PIPING IS INVOLVED

GRINNELL

Grinnell Company, Inc., Providence 1, R.I. Warehouses: Atlanta • Buffalo • Charlotte • Chicago • Cleveland • Cranston • Fresno • Kansas City • Houston • Long Beach Los Angeles • Milwaukee • Minneapolis • New York • Oakland • Philadelphia • Pocatello • Sacramento • St. Louis • St. Paul • San Francisco • Seattle • Spokane



Special Iron Sleeve with tapered wall thickness provides magnetic balance, permitting *low* current setting.

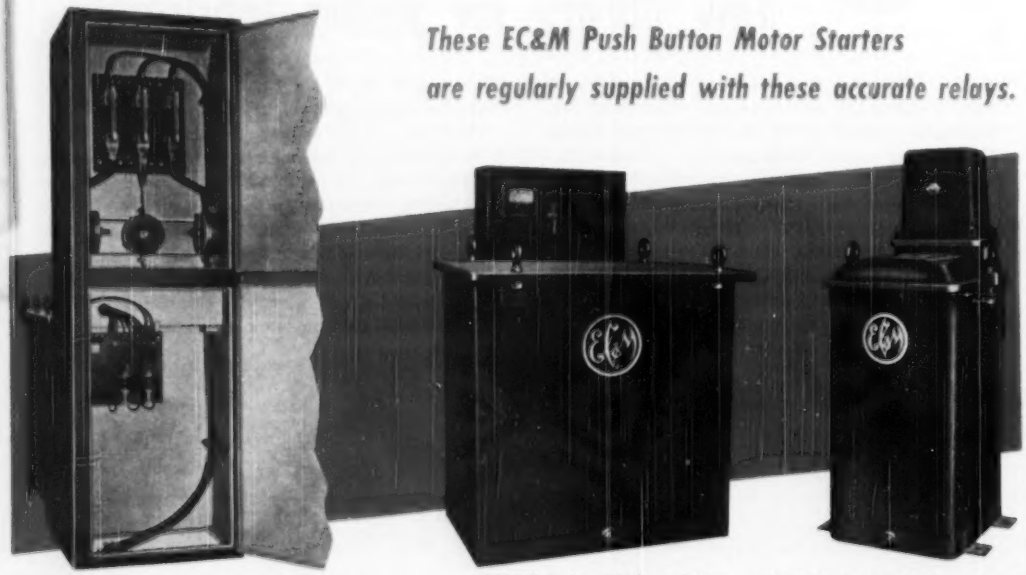
EC&M Type ZM Overload Relays for use in A-c Starters are of the magnetic type. They trip *instantly* on heavy overloads or short circuits and provide *inverse-time-element* trip on prolonged overloads or if the motor fails to start.

A *low* current-setting for accurate protection under running conditions is possible with these Relays because a magnetic-balance in each relay permits the absorption of the heavy inrush currents while the motor is accelerating. When the current is normal, the relay drops back automatically to keep timing at the maximum.

On short circuits the time-delay feature is bypassed. A spring on the outside of the dashpot-case normally holds the dashpot down, allowing the plunger to pull through the silicone fluid. When an excessive current occurs, the dashpot and plunger lift as a unit—the outer spring on the dashpot being compressed as the plunger *instantly* rises to trip the relay-contacts without delay.

Complete description of these Relays is given in Bulletin 1180-2 and No. 19 ACCELERATOR. Write for your copies.

These EC&M Push Button Motor Starters are regularly supplied with these accurate relays.



VALIMITOR Starters — 2300-4600 Volt Motors

2300 V. Reduced Voltage Starter

220-550 V. Reduced Voltage Starter

THE ELECTRIC CONTROLLER & MFG. CO.

2698 EAST 79th STREET • CLEVELAND 4, OHIO

How to get a fire-extinguishing system FREE!

An auto manufacturer had a mean fire hazard in some automatic screw machines.

The job called for a light oil coolant. With its low flash point the oil frequently caught fire from heat generated by machining.

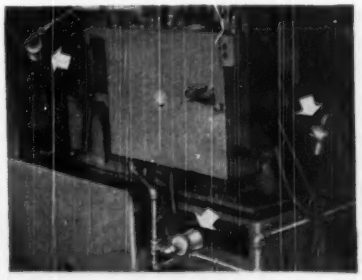
The extinguishers used by the company killed these repeated fires successfully. But the extinguisher chemical spoiled the coolant—left a mess on the machine. And downtime needed to clean the machine and replace oil after a fire was never less than 16 hours—often ran to 2 or 3 days.

Kidde extinguishing systems were installed on all these screw machines. They detect and kill fires automatically. The dry clean CO_2 discharged by the *Kidde* systems doesn't mess up the machine. It evaporates from the coolant oil, leaving no trace. After a fire, *downtime is 1 hour, no oil need be replaced.*

The *Kidde* systems cost $800 per machine. *The company says they paid for themselves in the first month!*

That's how our friends, the auto manufacturers, figure they got the *Kidde* installation free. You'd figure that way, too, wouldn't you?

If you want to know more about *how* such systems work, mail the coupon for literature.



Arrows show location of *Kidde* Multijet Nozzles through which CO_2 is discharged to kill fires starting on automatic screw machine during cutting operations. The CO_2 does the job fast—and clean.

Walter Kidde & Company, Inc.
330 Main Street, Belleville 9, N. J.

Gentlemen: Please send me descriptive literature on *Kidde* automatic extinguishing systems.

NAME .....

COMPANY .....

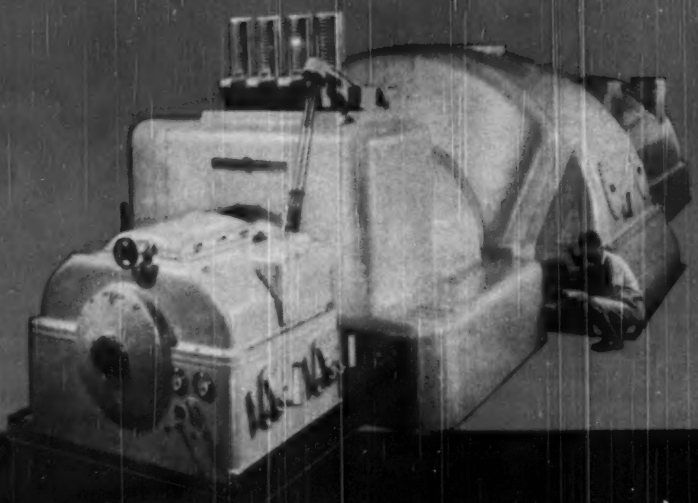
ADDRESS .....

CITY ..... STATE .....

Kidde

Walter Kidde & Company, Inc., 330 Main Street, Belleville 9, N. J.
In Canada: Walter Kidde & Company of Canada, Ltd., Montreal, P. Q.

Now—SURE PROTECTION AGAINST RUST in steam turbine lubricating systems—



GULF TURBINE FLUSHING OIL

Now—Gulf Turbine Flushing Oil has been further fortified to provide an even more effective rust preventive film! Now you can be sure that all oil bathed surfaces in your new turbine lubricating system are completely protected!

Gulf Turbine Flushing Oil has highly preferential wetting characteristics — displaces water quickly on the internal surfaces of the lubricating system. It should be used as soon as practical after installation of the system.

Gulf Turbine Flushing Oil has excellent flushing action — cleans inaccessible parts of the system, readily picks up dirt particles and carries them to the filter.

An important advantage of Gulf Turbine Flushing Oil over other types (such as certain solvents) is that the undrained portion in the turbine system does not impair the lubricating value of the turbine oil. For Gulf Turbine Flushing Oil is itself a satisfactory lubricant.

Only one-third to one-half of a normal turbine oil fill is required for thorough flushing. Thus the expense of flushing your new turbine with low-cost Gulf Turbine Flushing Oil is nominal.

For complete information on this quality product and for recommended procedure for cleaning your turbine, call in a Gulf Lubrication Engineer. Write, wire, or phone today.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION • GULF REFINING COMPANY

GULF BUILDING, PITTSBURGH, PA.

Sales Offices - Warehouses

Located in principal cities and towns throughout Gulf's marketing territory

NATVAR
in
SWITZERLAND
This 3125 KVA generator, 5750 volt, 3 phase, is typical of the large generating equipment built by Brown Boveri & Cie., A.G., in Baden, Switzerland. Natvar varnished cambric and varnished cambric tape were used in its manufacture.

Natvar

Natvar Products

- Varnished cambric—straight cut and bias
- Varnished cable tape
- Varnished canvas
- Varnished duck
- Varnished silk
- Varnished special rayon
- Varnished Fiberglas cloth
- Silicone coated Fiberglas
- Varnished papers
- Slot insulation
- Varnished tubings and sleevings
- Varnished identification markers
- Lacquered tubings and sleevings
- Extruded vinyl tubing and tape
- Extruded vinyl identification markers

Ask for Catalog No. 21

Continued demand for a product in a free market is strong proof of its *value*. Where the demand persists in spite of economic difficulties, it is also evidence of superior *quality*. In Switzerland, and other markets throughout the world, preference for Natvar insulating materials is steadily increasing.

Natvar insulations give dependable performance because they are skillfully made of the best materials available. They are always the same no matter when or where purchased.

Delivery can be promptly made either from conveniently located wholesaler's stock, or direct from our own.

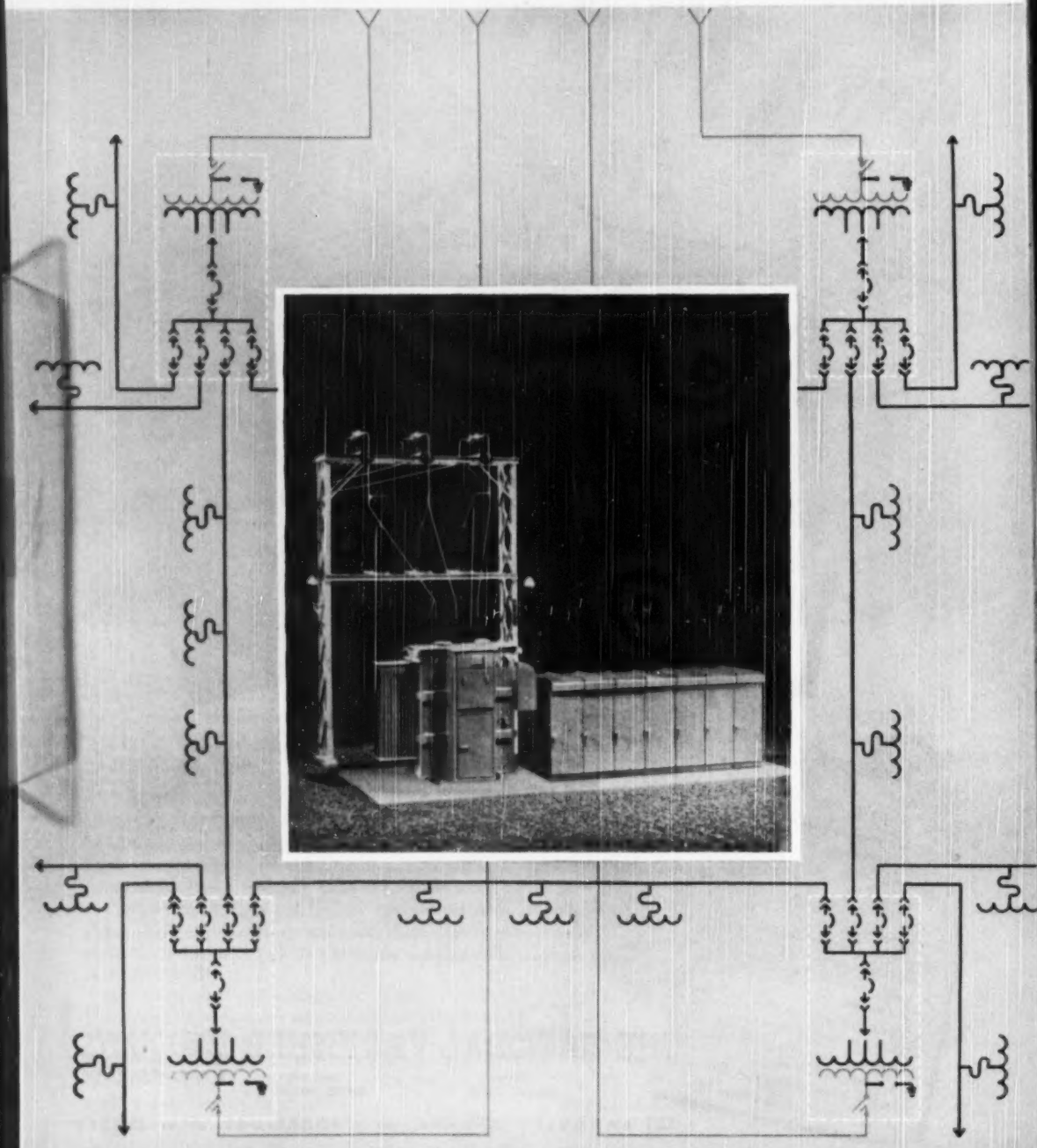
THE NATIONAL VARNISHED PRODUCTS Corporation

TELEPHONE RAHWAY 7-5800 — CABLE ADDRESS NATVAR: RAHWAY, N. J.

221 RANDOLPH AVENUE ★ WOODBRIDGE, NEW JERSEY

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Co-ordinated Substation of the Primary Network type energized from a single subtransmission circuit.

CO-ORDINATED SUBSTATIONS

Help Simplify Systems *and* Lower Power Distribution Costs

The substations you choose *now* will become vital tools in building simplified systems . . . *and* lowering power distribution costs; therefore, *their inherent design must provide for these factors.*

The Westinghouse Co-ordinated Substation, shown here, is one example. It is a compact standardized unit designed to economically answer Primary Network requirements. It is completely co-ordinated from incoming line facilities to outgoing feeders.

This relatively small, bus-regulated substation, and its associated system, economically simplify many distribution problems. Individual feeder regulation is eliminated. Fewer high-voltage breakers are required. The cost of switching on the subtransmission side of the station is reduced. Unitized construction provides flexibility for meeting future load requirements. Transformers and breakers can be quickly de-energized for maintenance . . . without service interruption.

As you plan for the future and gradually simplify your system, be sure you have considered the benefits of Westinghouse Co-ordinated Substations. Their part in long-range power distribution economies has been carefully considered in every phase of their design and construction. More information is given in Booklet B-4061. Ask your Westinghouse representative or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60729

Westinghouse

COORDINATED SUBSTATIONS

WESTINGHOUSE

PERMANENTLY FORTIFIED
for Life-Time Wiring Protection

Unlike ordinary rigid steel conduit, SHERARDUCT is fortified—*permanently fortified*—against rust and corrosion by the Sherardizing Process of dry galvanizing. A pure zinc coating, driven into the pores of the steel, becomes an integral part of the tube itself because it's *alloyed with the steel.* Furthermore, SHERARDUCT will not split or peel, and although it can be bent easily, it will not crack!

SHERARDUCT is still further protected against acids and other corrosive agents by the clear "Shera-Solution" coating, baked on for added endurance. The smooth inside surface makes fishing easy.

Specify SHERARDUCT. It's full weight, threaded, rigid steel conduit—*fortified* to give wires and cables a *life-time of protection.*

Sold through leading electrical wholesalers.
Listed by Underwriters' Laboratories, Inc.

National Electric
PRODUCTS CORPORATION

1305 CHAMBER OF COMMERCE BUILDING, PITTSBURGH 19, PA.

Made of Mist

LATE LAST MONTH the United States and Canadian governments signed a treaty which paves the way for greatly increased use of Niagara waters for power production. This treaty is still to be ratified. But there is little doubt that this will be done speedily on both sides of the border. Thus will be inaugurated a project which, if completed, can almost quadruple the power and energy being derived under the prevailing treaty. Both countries will share and share alike in this new supply.

By the time this power is available there will be plenty of use for it in the Northeast. But there will also have been plenty of argument about the auspices under which it was or should have been developed.

The public power crowd will hardly let this one go by default. But they may wish they had! Unfortunately for them they will have one of the weakest cases ever. This is so because long-established generating and transmitting systems blanket the area in which the new power could be utilized. This is no virgin territory serving as a lure for area developers. Nor was it that even in the mid-twenties when the present treaty was first proposed.

At that time it was demonstrated by local electric utilities that properly placed weirs and artificial islands in the Niagara River could redirect the flow most advantageously over the Canadian and American falls. This would achieve three things: (1) Full preservation of the precious scenic beauty, (2) reduction in the erosion of the horseshoe, and simultaneously (3) a greatly increased diversion for power purposes. The Niagara Falls Power Co for several years operated a model to show the honeymooning visitors that the scheme was practical. The International Joint Commission recommended these measures in 1928.

Nothing tangible happened for 22 years. Why? It appears there must have been something lacking in the educational program conducted by the hydro company. If it had been adequate there might conceivably have been quick acceptance of the idea. There should be real profit to the private power industry in examining the techniques that were—or were not—employed.

Those who today are attempting to ward off the incessant assaults on the power industry should make the study. They should find out why the program initiated in the twenties was so long deferred. And why it finally emerged at the convenience of the public power proponents. What was done that was ineffective? What could have been done to win speedier public recognition of the merits of the proposal. Disclosure of these defects could well point the way to greater effectiveness in meeting this and other issues still facing the industry.

Do as I Say, Not as I Do

WHAT GOODS DOES the smart merchant put up in the front of his store where everyone entering must see them? On what does he pour down hundreds of foot-candles of light in window and interior displays? On what does he put most of his selling effort?

"Elementary, my dear Watson. The goods whose sale brings him the most profit."

It does not follow from this that the merchant does not stock or will not happily sell the staple goods the customer comes into his store to buy. It is simply that he knows instinctively or has learned well what the term "selective selling" means.

There are a lot of power company commercial salesmen working up and down Main Street teaching selective selling to storekeepers. They tell how effective lighting encourages impulse buying, how modern store fronts and attractive windows entice passers-by, how traffic through the store can be routed to bring customer's eyes to the bargains displayed. All this and more they impress upon the merchant in order to sell more electric service to him.

We wonder sometimes how many of these salesmen's bosses—presidents, vice-presidents, managers and supervisors, whatever their titles may be—actually realize that their own way to salvation is through the gospel their men are preaching. And how many are they whose attitude is expressed by a remark made by one, "We're doing all right. Getting load as fast as we can take it."

We don't venture any opinion as to which of the two groups are in the majority. But we would be willing to make a bet, if there were any way of deciding it, that selective selling is more preached by power companies to their commercial customers than it is practiced by the companies themselves.

Station Batteries

THE GROWTH in fault-clearing duty and reclosure speed, to say nothing of the recent mild epidemic of system outages, should focus attention on the station batteries. There should be interest in their adequacy to supply the control currents when an emergency arises requiring the actuation of a large number of circuit breakers in few but hectic moments when clearing the trouble and restoring the service are uppermost. Voltages are likely to be low, and the battery-charging equipment that usually carries all the normal draft may not even be operating.

During these periods the battery is all-important, and it answers in no uncertain terms whether its rating has been selected in full anticipation of the prospective or putative needs.

One question in particular should arise and that is the ability of the battery to deliver the 112.5-v minimum for which so many of the breaker closing mechanisms have been built. The 112.5 is 90% of the rated 125-v value. Accompanying this for-the-battery high figure is, as has been indicated, the increased current demand for operating heavier solenoids on heavier breakers devised for heavier duty.

While a 60-cell battery is nominally referred to as a 120-v battery, its stabilized open circuit voltage when fully charged will be a few volts higher; the voltage during float-charge is 129 v. Allowance should be made for internal voltage drop and, say, 10 v in the control wiring.

Under such conditions and assumptions it is not possible to maintain 112.5 v at the solenoids either when the battery is (1) under charge or (2) not under charge.

There are several ways out, but not all are practically available because some are prohibitively costly:

1. A battery with tripled or quadrupled ampere-hour capacity would alleviate the situation but be too expensive.

2. Extra cells could be added to raise the battery voltage, but the end-cell charging and control would be much more complicated.

3. Increase control wire size so that the voltage drop would be substantially reduced.

4. Lower the minimum operating voltage for circuit breaker actuating mechanisms from 112.5 to, say 100 v.

Offhand it seems that the latter move should be deemed the least objectionable. Anyhow the ASA standards stipulate 90-130 as the voltage operating range for nominal 125-volt equipment. Twenty volts above the minimum is a trend of practice which should be reviewed in the light of present operating experience and the inherent limitations of chemical energy storage.

Colored Refrigerators? Oh, No!

SEEMS THAT the Society of Industrial Designers is sniffing around the idea of colored refrigerators, according to report in *Business Week* of their recent meeting in Milwaukee.

Our advice is, "Don't." It has been tried and it doesn't work. No matter how many tints and shades are offered, the average housewife will want another color, a little darker or a little lighter. And even if she finds exactly the hue she wants, she'll probably be unhappy with it in a few years when she thinks the kitchen should be done over. And that will be long before the end of the refrigerator's useful life. She'll be faced with three choices—give up the idea of doing the kitchen over, do it over and let the refrigerator clash with the new color scheme, or sell the refrigerator at a loss and try to find another that blends in with the color effect she wants.

A choice between two is usually enough to make a woman unhappy. Think how snappish she'd be if she had to choose one of three.

And when colored appliances were tried some years back, dealers that first greeted them with loud huzzas soon found they were a pain in the pocket. Distributors and manufacturers quickly felt the same acute pain in the same place. Again we say "Don't! Keep to the snowy white for refrigerators, ranges, and such."

The Electrical Week

Cloud seeding can be profitable for a utility with hydro plants. At least California Electric Power Co thinks so. For the past two years it has been seeding clouds in the Bishop Basin and has increased precipitation by 12% plus (p 70)... The industry wasn't dreaming that it was putting an extraordinary amount of capacity on the line last December. It really did. For a list of the plants which made up the fantastic record total of 1,087,025 kw see p 72 ... Now it's out —the reason the Department of Interior has been holding up the contract between the Southwestern Power Administration and two Oklahoma utilities. Interior is afraid that SPA will lose money serving municipalities (p 73)... Manufacturers need not be too happy about the way the coal strike ended. The Lewis victory, and it was a Lewis victory, plus the large profits reported by electrical manufacturers are encouraging union leaders to stiffen their demands in contract negotiations (p 74)... And the Securities and Exchange Commission has released its annual report for fiscal 1949 showing an increase in utility financing (p 75).

• • •

The number of large incandescent lamps shipped in 1949 approximated 850 million. The demand seems unlikely to exceed much this figure for several years to come because lamp life has grown longer.

At the end of January the Rural Electrification Administration had received 144 applications for phone loans from 36 states. Kansas leads with 14 applications, followed by Texas with 12.

Broadest grin in Washington last week belonged to Interior Secretary Chapman. If the coal strike had not ended, he most likely would have been given the job of running the coal business for the government.

Counterpart funds accumulated by nations receiving ECA dollars during the program's first 19 months totaled the equivalent of $2,536.9 million, of which $186.4 million was for electric, gas, and power facilities.

Annual use of artificial light in the United States is now estimated at 100 thousand billion lumen-hours, equivalent to 12 million lumen-hours per capita annually.

"What may be the fiercest competition since the middle 1930's appears to be prevailing in the general contracting industry in the construction of buildings, highways, railroads, public utilities, dams, and other engineering projects," declares the Associated General Contractors of America, Inc. Construction costs, says the contractors association, "are tending to stabilize at approximately 10% below the peak of 1948."

Sales of electricity for lighting alone exceeded 80 billion kwhr in 1949.

Largest pre-payment ever made on an REA loan was presented Administrator Wickard by the Lower Colorado River Electric Cooperative of Giddings, Texas, Jan 24. Amount: $262,000.

Piacenze, Italy, steam plant of Societa Edison will be stepped up to 100,000 kw capacity by replacing two 11,000-kw units with new 50,000-kw turbo generators. Economic Cooperation Administration is financing the project to the tune of $9,923,000.

The Indian government is one that has abolished red tape. In the future it will be white because it is cheaper and red is the British imperial color. But we bet everything will be tied in knots just as effectively as before.

Bureau of Reclamation's A. W. Simonds, an expert on grouting of dam foundations, has been sent to New Zealand to assist engineers working on Maraetai Dam, a New Zealand project which will have a power capacity of 250,000 kw.

Notes From The News

January ice and snow damaged the lines of the Clark County (Wash.) PUD so severely that the PUD will be forced to raise electric rates in order to repay a loan made to get repair funds ... Nebraska public power groups are getting together so that they can get Missouri Basin power. The Reclamation Bureau has threatened to build transmission lines in the state if they didn't ... After two serious outages caused by the low quality of coal used because of the coal strike, the Cleveland Municipal System was hit hard on March 2 when a short circuit developed in a 11-kv feeder. Some 217 industries, 8,000 commercial users, and approximately 50,000 homes were without service from two and a half to six hours. The Municipal is not interconnected with Cleveland Electric Illuminating Co ... The Texas Legislature has passed a law permitting rural telephone co-ops to build lines financed by REA loans.

Cloud Seeding Works in California

Calepco Uses Dry Ice and Silver Iodide to Increase Snowfall in Bishop Basin; Results of 2-Year Experiment Show Precipitation Up Over 12%

WHILE NEW YORK CITY debates the feasibility of rainmaking to solve its water shortage, California Electric Power Co has announced that it has been seeding clouds for the past two years to increase snowfall for water and power production.

This is the first commercial application of aerial cloud-seeding for water and power production purposes.

California Electric, which revealed its cloud-seeding project several weeks ago, has estimated that the operation has raised the snowfall feeding its five hydro plants in the High Sierra by 14% in 1948 and 12% in 1949.

Got 14.3 Million Kwhr

Beginning operations in January, 1948, California Electric made 21 flights over a 210-day period to achieve a total of 6,500 acre ft of bonus run-off—equivalent to 14.3 million kwhr. The company said that to generate the same amount of power at steam plants would have cost $56,000. It cost the power company some $200 an hour to keep its P-38 seeding plane in the air.

Operations were carried on at Bishop, Calif., over a cup-shaped basin which is the snow-collecting reservoir supplying five California Electric tandem plants.

Avoided 'Dry Cycle'

Albert Cage, company president, believes that the aerial seeding project was a prime reason for the company's ability to operate its plant at full capacity despite the "dry cycle" which hit California several years ago. The company serves 50,000 customers in California, part of Nevada, and in northern Mexico.

Stuart Cundiff, the company's engineer in charge of operations, suggested the seeding experiment in 1947. The entire operation was conducted in secrecy, partially because there is yet no legal decision on whether seeding operations deprive other areas of potential snow. However, California Electric has built up meteorological and operational data indicating that had the clouds not been tapped, they probably would have dissipated themselves over the mountains.

An average seeding run requires from 20 to 100 lb of finely chopped dry ice. Clouds averaging 3,000 ft or under in thickness are seeded with dry ice the size of rice grains. Larger clouds require pieces ground to thumb size.

Evaluation of snowfall and resulting precipitation is gauged by three recorders in the collecting basin. These recorders graph the beginning of a storm and its duration and measure the amount of precipitation from the snow.

California Electric's sustained operations were based on preliminary findings of General Electric Researcher V. J. Schaefer. In collaboration with the U. S. Army Signal Corps, Schaefer found in 1946 that by dropping 3 lb of dry ice into a small cloud at 14,000 ft near Schenectady, N. Y., he was able to produce snow within three minutes after the seeding.

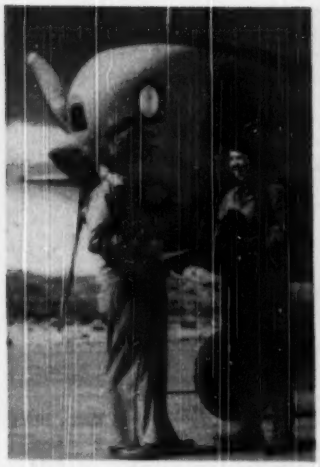
Experiments with silver iodide were also successful. While dry ice will melt in the atmosphere or plunge through a cloud to the ground, light-weight silver iodide floats like pollen. Thus dry ice must be dropped into the cloud mass directly, while silver iodide is ejected on the same level as the cloud, acting as an ambush to trigger passing clouds.

Bishop, which lies at 4,100 ft, requires use of dry ice because clouds hang low over the valley, making low

(Continued on Page 72)

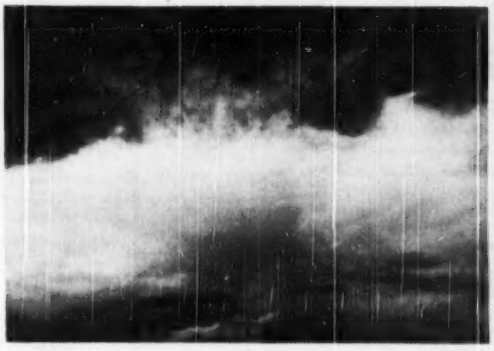
Snow Trap

. . . in the mountain-rimmed upper basin of Bishop Creek, near Bishop, Calif., is utilized by California Electric Power Co. to store the product of its cloud seeding operations. Run-off of mountain snow collects in reservoirs and lake at the foot of the peaks. It is then dropped through a series of five hydro plants with a total rated capacity of 27,675 kva. Water is returned to Bishop Creek below the last power plant in the series.



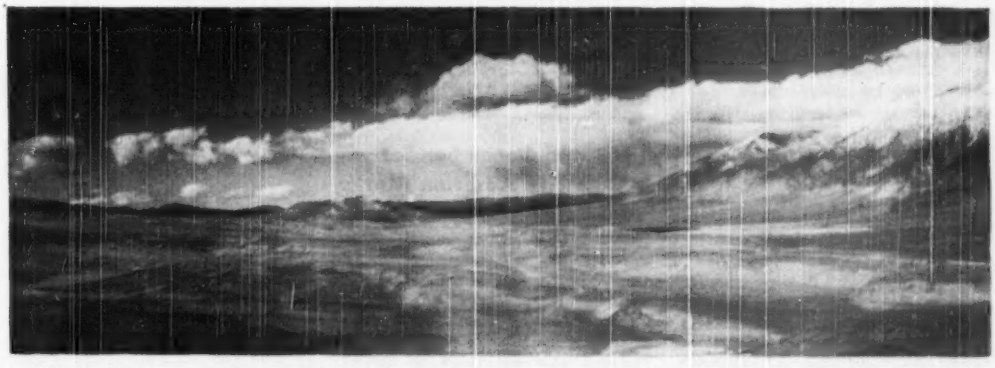
1 READY for a flight to seed clouds are Pilot Bob Symons, right, and Stuart Cundiff, engineer for California Electric

2 CUMULUS CLOUDS towering over Bishop Basin are observed by plane crew. Notice that leading edges of clouds, right, are already beginning to break up and evaporate as they come in contact with dry air rising from desert on other side of High Sierras



3 FIVE MINUTES after seeding, the cloud appeared like this. Note the effect of updrafts and turbulences within cloud mass. This shows seeding path. Dry ice, the size of rice grains, was used

4 CLOUD begins to develop in size and first signs of virga (storm) appear on its underside. Note that, as in second picture, there is practically no snow on peaks of mountain beneath the cloud



5 AS STORM spends itself and passes out of the valley, an atomic-cloud effect becomes evident. Now additional snow can be seen on the mountains below showing that the seeding operation has been successful. The utility plans to continue the cloud-seeding project

altitude flying—necessary for seeding with silver iodide—unsafe.

For successful cloud seeding, conditions must be atmospherically susceptible. It is necessary that there be super-cooled clouds where the temperature is below 32 deg F. Essentially, seeding is a process of nucleation. Clouds over mountain ranges at below freezing temperatures are composed of water droplets. Scientists have found that to form snow flakes the water droplets need nuclei around which to form. In the case of dry ice, seeding forms artificial nuclei by quick freezing some droplets to ice crystals. With silver iodide, seeding provides ready-made nuclei.

The U. S. Weather Bureau, which is officially skeptical of seeding operations, doubts whether a two-year cloud triggering period can be called conclusive. However, one of its meteorologists, Elvyn C. Pye, who runs the Bishop weather station, declares that "personally I am convinced that California Electric Power Co has created snowfall here. The evidence seems positive."

Just what application California Electric's experience with cloud-seeding may have for other utilities is not yet known. The conditions peculiar to Bishop, with its high ranges, moisture-laden clouds blown by winds from the Pacific, and cup-shaped collection basin, may be a limiting factor. However, the company's engineers believe that their experiments may be duplicated in other parts of the nation where utilities rely upon snow run-offs for power.

•

Rio de Janiero Company Bidding on Floating Plant

(McGraw-Hill Worlds News)

The Rio de Janeiro Tramway, Light & Power Co is bidding on the floating power plant being offered for sale by the Puerto Rico Water Resources Authority. The Brazilian utility believes the plant could be functioning by early 1951 in Rio harbor. It would add some 25,000 kw of capacity.

An unusual dry spell has caused a power shortage in the Brazilian capital. Daylight Saving Time has been established, and power rationing ordered.

•

To Use Gas Turbines

Public Service Co of Oklahoma will build a 12,000-kw gas turbine power plant at Elk City. The first 6,000-kw unit will be installed this summer, the second in 1951 or 1952. Arrangements have been made to get gas from the Elk City gas field.

Changes in Capacity Reported to Federal Power Commission

PLANT ADDITIONS DURING DECEMBER

Utility	Plant	Fuel	Capacity (KW)
Bangor Hydro Electric Co	Orono, Me.	H	1,880
Public Service Co. of New Hampshire	Schiller	S	49,000
Western Massachusetts Electric Co	W. Springfield	S	45,000
Lynn Gas & Electric Co	Lynn, Mass.	S	10,000
Connecticut Light & Power Co	Devereaux, Mich.	S	60,000
Cincinnati Gas & Electric Co	Miami Fl.	S	80,000
Cleveland (Ohio) Electric Illuminating Co	Avon	S	75,000
Rantoul Light & Water Plant	Rantoul, Ill.	S	2,000
Springfield (Ill.) Water, L & P Department	Lakeside	S	20,000
Central Illinois Electric & Gas Co	Rockford	S	20,000
Dowagiac Electric & Water Department	Dowagiac, Mich.	IC	1,136
Wisconsin-Michigan Power Co	Quinesec, Fla.	H	8,000
Wisconsin-Michigan Power Co	Wey Dam	H	1,800
Consumers Power Co	Weadock, Mich.	S	60,000
Consumers Power Co	Weadock, Mich.	S	60,000 (Nov)
Gresham Municipal Light & Power Department	Gresham, Wis.	H	100
		IC	200
Menasha (Wis.) Electric & Water Utilities	Menasha Steam	S	8,000
Wisconsin Power & Light Co	Blackhawk	S	25,000
Madison Gas & Electric Co	Madison, Minn.	S	1,500
Border Counties Power Co-op	Warroad, Minn.	IC	995
Interstate Power Co	Heron Lake, Minn.	IC	1,000
Northern States Power Co	Mobile Unit, Minn.	IC	760
Otter Tail Power Co	Crookston, Minn.	S	5,000
Milford Municipal Light & Water Works	Milford, Iowa	IC	500
Estherville Electric Department	Estherville, Iowa	IC	2,250
Interstate Power Co	Lansing, Iowa	S	11,500
Harlan Light Power & Department	Harlan, Iowa	IC	1,950
Central States Electric Co	Britt, Iowa	IC	1,150
Missouri Power & Light Co	Mexico, N. D.	S	7,500
Montana-Dakota Utilities Co	Dakota	S	7,500
Otter Tail Power Co	Langdon, N. D.	IC	1,000
Rosebud Electric Association	Gregory, S. D.	IC	870
Pierre Water, Light & Power Department	Pierre, S. D.	IC	2,120
Blair Electric Department	Blair, Neb.	IC	1,315
Auburn (Neb.) Board of Public Works	Plant No. 1	IC	1,000
Red Cloud Electric Department	Red Cloud, Neb.	IC	554
Omaha Public Power District	Omaha, Neb.	S	30,000
Fredonia Water & Light Department	Fredonia, Kan.	IC	1,700
Greensburg Municipal L & P Department	Greensburg, Kan.	IC	690
Western Light & Telephone Co	Great Bend, Kan.	IC	2,460
Appalachian Electric Power Co	Philip Sporn, W. Va.	S	125,000*
Tarboro Electric Department	Tarboro, N. C.	IC	3,735
New Bern Water & Light Department	New Bern	IC	1,000
Duke Power Co	Dan River (N. C.)	S	70,000
Savannah Electric & Power Co	Riverside, Ga.	S	80,000
Florida Power Corp	Bayboro, Fla.	S	10,000
Florida Power & Light Co	Cutler	S	40,000
Louisville (Ken.) Gas & Electric Co	Paddy's Run	S	60,000
Tennessee Valley Authority	Wilson Dam, Ala.	H	25,200
Tennessee Valley Authority	Wheeler Dam, Ala.	H	38,400
Ruston Water & Light Department	Ruston, La.	IC	2,470
Oklahoma Gas & Electric Co	Alva	IC	675
Black Hills Power & Light Co	Osage No. 2, Wyo.	S	11,500
California-Pacific Utilities Co	Cobaville, Wyo.	IC	80
La Junta Municipal Utilities	La Junta, Colo.	IC	1,250
Colorado Springs Dept of Public Utilities	Colorado Springs	S	10,000
Public Service Co of New Mexico	Santa Fe	S	6,000
Gallup Electric Power Department	Gallup, N. M.	S	4,500
Eugene (Ore.) Water Board	Watervolt	H	8,000
Bureau of Reclamation	Keswick, Calif.	H	25,000
Pacific Gas & Electric Co. (Calif.)	Cresta	H	33,750
Pasadena Municipal Light & Power Department	Pasadena, Calif.	S	35,000

PLANT RETIREMENTS DURING DECEMBER

Plant retirements, which totaled 55,744 kw, will be listed in a later issue

* Note: Reported in operation for testing purposes only, as of Jan 1, 1950.

H—Hydro, IC—Internal Combustion, S—Steam.

United States Capacity as of Jan. 1—Steam, 44,997,563 kw; Internal Combustion, 1,774,222 kw; Hydro, 16,594,786 kw; Total, 63,666,571 kw.

1949 and December Set Capacity Addition Marks

When it came to adding capacity 1949 was a record year and December was a month the like of which the industry may not have in another decade.

For the year a total of 6,410,910 kw was installed to raise the nation's central station total to 62,666,571 kw. The net gain was 6,106,733 kw or 10.8%. Retirements were still on the low side but were increasing.

In December the fantastic total of 1,087,205 kw was added. This included one 125,000-kw unit that was on the line for test purposes (See table adjoining). The previous high point was December, 1948, when 756,583 kw were installed.

•

Wins 30-Year Franchise

Florida Power & Light Co has won a 30-year franchise election at Sanford.

CANADA and United States sign treaty providing for the diversion of the waters of the Niagara River. At left signing for the United States is Secretary of State Dean Acheson. Watching are Sen Herbert H. Lehman of New York, center, and H. H. Wrong of Canada

Interior Sees SPA Loss, Delays Utilities Contract

The Department of Interior's objections to the proposed contract (EW, March 6, p 6) between Southwestern Power Administration and two Oklahoma power companies center on provisions for serving municipalities, ELECTRICAL WORLD learned last week in Washington.

Interior fears that under terms of the contract proposal Administrator Douglas G. Wright of SPA brought to Washington Dec 23 SPA might be put in a position of losing money in serving municipalities now receiving power from a private utility. This fear is blamed for the delay by Interior officials in approving the contract.

The problem could arise in the case of a city which is now served by a company and seeks SPA power. Under terms of the agreement reached by Wright and the companies—Public Service Co of Oklahoma and Oklahoma Gas & Electric Co—the city now served by the company would be a Class A customer. SPA could serve the city, according to the agreement, but it would have to pay the company its prevailing wholesale power rate. This provision, designed to protect the companies from "raids" by SPA, may be blocked or modified by Interior. Here's why:

The city, qualified as a "preference customer," would seek service at SPA's Class A rate of 5.8 mills. But SPA, to serve the city, would have to pay the company a wholesale rate in the neighborhood of 11 mills. The transaction adds up to a 5-plus-mill loss to SPA for every kwhr sold under this arrangement. Interior says it would be a "subsidy to the companies."

One answer which SPA is certain to make to this argument is that it is not going to have enough power to get into this type of service for some time. SPA's contracts with Rural Electrification Administration-financed generation and transmission co-ops, plus other co-op demands will probably take much if not most of SPA's available power.

•

Georgia Power Raises Home Town Prize List

Public response has been so great to the Champion Home Town Contest sponsored by Georgia Power Co that the list of prizes and classifications has been increased. Cash prizes will total $7,950 in the contest for 1950.

Three identical sets of prizes will be offered for towns under 1,000 population, those from 1,000 to 5,000 and from 5,000 to 20,000. Larger cities are not eligible to compete.

Prizes of $1,000 for first, $750 for second, $500 for third place winners will be awarded, and four honorable mention winners in each group will receive $100. The cash prizes to be won by the communities must be spent for civic improvement.

Last year 266 Georgia communities entered the contest, and 211 completed filing of a progress report.

Douglas County PUD Buys Bit of Chelan Lines

The Douglas County PUD of Waterville, Wash., has purchased from the Chelan County PUD for $1,090,000 a portion of the power system the Chelan group bought from the Puget Sound Power & Light Co last year.

The sale includes lines in Douglas County and a small section of adjacent Grant County. It affects 14% of the customers served by the Chelan PUD and about 11% of the Chelan district's total gross revenue.

George Hamilton, Douglas PUD president, and L. J. Richardson, Chelan president, said the Chelan district, at the time it bought the Puget Sound properties, agreed to sell the Douglas County system when that county was able to finance the purchase. Financing was arranged through a loan from the REA.

Commissioners of the two districts have agreed that the Chelan district will continue to operate the property in Douglas and Grant Counties for a minimum period of four months, or until about June 1. William T. Hordeen, former industrial consultant for the Chelan PUD, will represent the Douglas district as its resident manager in connection with the purchased properties and will maintain his office in the Chelan County office.

Power for the proportion sold will be furnished by the Chelan district under an 80-year contract at the prevailing Bonneville rate. Major portion of the sale proceeds will be used by the Chelan district to retire its revenue bonds and to build up reserves for bond retirement, said Richardson. The Chelan PUD paid $2,028,000 for the properties it purchased from Puget Power, plus additional amounts for accounts receivable and other items.

•

To Buy 2 Systems

Appalachian Electric Power Co has been given permission by the West Virginia Public Service Commission to purchase the distribution systems in two mining communities in Mingo and McDowell Counties. Both systems have been operated by mining companies for their employees.

•

To Double Plant Capacity

Southwestern Gas & Electric Co will double the capacity of its Knox Lee Plant on Lake Cherokee in Gregg County, Texas. The second 35,000-kw unit is to be in operation by early 1951.

LABOR

Lewis's Victory, Company Profits Cause Unions to Stiffen Demands

UNIONS ARE stiffening their bargaining attitude because of John L. Lewis' wage victory in the coal mines and the big profits reports of the large manufacturers.

In the electrical industry, there will be an additional factor: the General Motors negotiations and the collaboration between Walter P. Reuther's Auto Workers and the new CIO International Electrical Workers Union.

Not long ago it was figured that the unions in the major negotiations this year would shoot for pensions better than the Ford and steel patterns—and feel lucky if they got them. Now they want more than that. They also want a wage increase.

Will Seek Higher Pensions

Lewis won a 70¢ daily wage increase, plus a 10¢ boost in the tonnage royalty for the miners' retirement and welfare fund. The total royalty is now 30¢ a ton. A miner produces about 6 tons a day, average. That's $1.80 a day, or more than 22¢ an hour. Other industries, in better profit positions than the coal mines, have been paying pensions less than half that much. Union bargainers will indicate that.

Reuther's demands on GM bear this out. The GM contract expires May 29. In the new one, Reuther wants a total package costing 31¢ an hour. It would be split up on non-contributory pensions of $125 a month, instead of the pattern of $100; health insurance; severance pay; improved vacation allowance; and a general wage increase.

IUE, UAW Will Cooperate

James B. Carey, IUE-CIO director, says he won't settle with GM without Reuther's approval. Then he will try to force the same settlement on the rest of the electrical industry, if the IUE-CIO wins bargaining rights in a majority of the Westinghouse and General Electric plants.

The GM negotiations likely will lead the way in electrical industry bargaining, so will have a considerable influence on other settlements. The bargaining situations in GM and electrical plants have this much in common: They will cover two years, company profits are good, and the CIO will do most of the bargaining on the union side.

The United Electrical Workers, expelled from the CIO, can upset CIO strategy if it keeps a foothold in major parts of GE and Westinghouse. But it may not be too easy to deal with, either. It recently publicized a new agreement with Westinghouse Air Brake Co calling for $125 monthly pensions, including social security, plus health and life insurance. The plan is contributory, with workers contributing 2.9¢ to 4.3¢ an hour for pensions and the company paying 20.3¢ an hour for both pensions and insurance.

•

Union Strife Following IUE Win in GM Plants

The bitter union fight in the electrical manufacturing industry is entering the showdown stage amid name-calling, charges of government collusion, and threats of prolonging the jurisdictional strife.

The new CIO electrical union scored the biggest of a series of election victories when it drove out the left-wing United Electrical, Radio & Machine Workers (ex-CIO) as bargaining agent in General Motors' five electrical plants.

This set off a cross-fire of claims and charges culminating in a "we will return" vow by Albert J. Fitzgerald, UE president.

Charging collusion between the National Labor Relations Board and the rival IUE-CIO in holding the GM election before those at Westinghouse or General Electric, Fitzgerald wound up with the promise: "The UE will be back in the electrical division of GM."

James B. Carey, leader of the CIO forces challenging the UE's bargaining status in electrical plants, hailed the victory as the "beginning of the end of Communist control" over workers in the electrical industry.

The IUE-CIO and the UAW-CIO have agreed that neither will make a contract settlement with GM this year without the approval of the other.

IUE-CIO walked away with the Feb 28 election at GM plants by a total vote of 21,167 to 2,526, getting big majorities in each of the five GM plants. Bargaining on a contract that expires in May will begin soon.

Hearings on proposed elections covering Westinghouse and GE have been completed. Elections will probably be held in April.

Westinghouse and GE have terminated their agreements with the UE as of April 1, the expiration date. GE has announced it will continue the same wages and other employee benefits until a new contract is signed.

NLRB to Rule If Worker Must Pay and Not Belong

Whether a worker can be forced to give financial support to a union while he is denied membership in the union will be decided by the National Labor Relations Board in a case involving Public Service Co of Colorado.

An NLRB trial examiner has held that the utility and IBEW Local B-1436 are guilty of an unfair labor practice because a worker was dismissed for refusing to pay $2 a month to the union. Under the company-union pact certain workers at the Boulder Plant do not have to belong to the union but must pay $2 a month, equivalent to dues, for the support of the bargaining unit.

In this case the employee, Charles G. Smith, insisted that he be taken into the union. He paid the initiation fee of $3.50 and $4 for two months' dues. The union returned the initiation fee but kept the $4 for the support of the bargaining unit.

The requirement for "support money" in the union contract is illegal, according to the trial examiner. The Taft-Hartley Act permits a union only to insist on union membership as a condition of employment.

•

Electrical Workers Get Top Pay in Construction

Electrical construction workers earned an average of $86.85 a week during December, the highest weekly wages paid in special construction trades, the Bureau of Labor Statistics reports.

Two things contributed to the high pay for electricians: (1) the longest work week, which averaged 39.2 hours, and (2) the second highest hourly earnings, $2.21½.

Hours and weekly earnings declined from those of a year earlier. Average weekly pay in December, 1948, was $87.58, or 73¢ higher. The work week for that month was 40.4 hours, 1.2 hours longer. The hourly pay, however, was 4.6¢ an hour less.

•

Utility Grants Raise

Central Arizona Light & Power Co has signed a new, three-year contract with the IBEW, Local 387. The agreement provides for pay increases for journeymen and apprentices ranging from $5 to $15 a month. Provision is also made in the contract for earned vacation pay for employees who leave the company or who are dismissed.

FINANCIAL

Yields—Operating Electric Utility Securities

Date or Period	Bonds			Preferred Stocks			Common Stock		
	1st Quality	2nd Quality	3rd Quality	1st Quality	2nd Quality	3rd Quality	1st Quality	2nd Quality	3rd Quality
1950									
Mar. 2	2.57%	2.58%	2.70%	3.80%	4.00%	4.40%	5.22%	5.73%	6.49%
Feb. 23	2.57	2.59	2.70	3.80	4.00	4.42	5.25	5.80	6.57
1949									
Feb. 28	2.72	2.80	2.94	4.01	4.27	4.69	5.79	6.85	8.46
Feb. 21	2.72	2.80	2.95	4.02	4.28	4.69	5.78	6.93	8.47
LAST FOUR QUARTERS									
4th 1949	2.59	2.61	2.72	3.85	4.06	4.46	5.37	6.15	7.01
3rd 1949	2.61	2.65	2.77	3.88	4.15	4.54	5.55	6.47	7.51
2nd 1949	2.69	2.75	2.88	3.98	4.26	4.66	5.94	6.96	8.14
1st 1949	2.70	2.78	2.92	4.00	4.27	4.67	5.78	6.69	8.08

Data: Reis & Chandler, Inc.

CURRENT YIELDS on securities of operating electric utilities are shown above, with comparative figures for the corresponding weeks a year ago and final figures for the last four quarters. These indexes, a service of ELECTRICAL WORLD, will appear weekly.

Higher Ratio of Financing Is Equity, Says SEC Report for Fiscal 1949

VOLUME of security issues sold by electric and gas utilities during the fiscal year ended last June 30 showed a slight gain over the previous year, the fifteenth annual report of the Securities and Exchange Commission showed last week.

The report, covering only issues subject to SEC regulation but including "a high proportion of total financing within the industry," revealed these trends:

Increased proportion of stock issues accompanied by decline in volume of bond issues.

Sharp decline in refunding.

Extensive use of rights offering procedure.

Total for issues in fiscal '49 was $1,697,469,175, compared with $1,689,456,287 in the preceding year.

Bonds dropped from $1,087,266,075 in '48 to $899,434,729 in '49, and common stock jumped from $226,439,063 to $364,016,666. Debentures were up from $146,307,321 to $241,238,500, while preferred stock dropped from $229,443,828 to $192,779,280.

Noting that management "has been faced with the basic problem of maintaining a proportion of equity capital sufficient to safeguard the financial strength of the industry," SEC declares, "Figures for the latest fiscal year provide an encouraging answer to this responsibility, for while the aggregate of bond and debenture financing declined about $93 million as compared with the fiscal year 1948, common stock sales advanced by more than $135 million.

During fiscal '49 refunding took only 5% of net proceeds, contrasted with 25% for fiscal '48.

"Thus," says SEC, "the general industry program for refunding debt and preferred stock issues with lower coupon issues which had reached very large proportions in the early postwar period seems to be approaching termination and the period from July 1, 1948, to June 30, 1949, saw financing geared almost exclusively to new-money needs."

"Extensive employment" of rights offering was a "significant feature of utility financing during the fiscal year," the report observed, adding, "The ability of the utility industry to go back to its stockholders for an important segment of its capital requirements is, in a sense, a tribute to the financial strength and investor confidence which it now enjoys."

•

Ohio Municipal Systems May Soon Be Taxable

Taxation of real estate used by Ohio municipalities for electric systems is coming closer. A State Supreme Court decision of March 1 upheld taxation of Cleveland's municipal stadium and adjoining parking lots. The court held that the city operates these in a proprietary capacity rather than as a function of government.

The decision may influence rulings in two similar cases now pending in the Franklin County (Columbus) courts. One would make all city proprietary functions subject to taxation, and the other would make all city-owned transit lines pay the same vehicle tax as privately owned companies pay. Most municipal systems pay no taxes.

Con Ed Withdraws Offer for Long Island Lighting

Consolidated Edison Co has withdrawn its application to acquire control of the Long Island Lighting Co system. The action was taken because of "changed conditions since the filing of the application in 1948," Con Ed said.

Several weeks ago Con Ed officials told the New York Society of Security Analysts that the acquisition of Long Island was "less interesting" because of the increase in the market value of Long Island's securities over book value since the offer was made.

Originally Consolidated Edison had proposed to exchange $28 million of its own convertible debentures for 100% of the new Long Island common stock to be issued after the company's pending consolidation with its two subsidiaries.

Long Island Lighting still is involved in litigation with stockholder groups over the terms of its reorganization. Enforcement of the utility's consolidation plan was ordered recently by U. S. District Court in Brooklyn. It will be delayed, however, pending an appeal by a committee of common stockholders. Disposal of the appeal might take until June, a company spokesman estimated.

FINANCIAL BRIEFS

Shawinigan Water & Power Co, Quebec, plans to issue $15 million in 3% bonds, Series Q, and $5 million in 4½% preferred stock. The bonds are expected to be offered in this country and the stock in Canada.

Idaho Power Co plans to sell additional 4% preferred stock later this year to raise up to $4 million to finance its 1950 construction costs. This year's building will substantially complete the company's postwar expansion program.

New England Power Co has been authorized by the Massachusetts Department of Public Utilities to issue 140,000 shares of additional $20-par common stock at $25 a share. Proceeds would be applied to retirement of $3.5 million of notes to banks.

Next year may be a bad one for General Electric Co, and perhaps for other electrical manufacturers too, if a trend uncovered by the Foundation for the Study of Cycles, Riverside, Conn., continues. The Foundation's study of GE orders received since 1893 shows a consistent rhythm with a wave period of about six years. If the pattern holds

good, GE can expect crests in orders in 1954 and every sixth year thereafter, with troughs coming in 1951, 1957, etc.

Washington Gas & Electric Co plans to sell its holding in Southern Utah Power Co, Cedar City, to the Southwest Utah Power Federation, a co-operative. Base price for the 62,910 shares of no-par common stock would be $550,000. Washington is reorganizing under the Bankruptcy Act.

Stockholders of United Light & Railways Co and its subsidiary, Continental Gas & Electric Corp, have approved the plan for liquidation of both companies already approved by Securities and Exchange Commission.

Metropolitan Edison Co, Reading, Pa., has been ordered by the Public Utility Commission to maintain current domestic service rates in York County. However, Metropolitan was relieved of the necessity of keeping separate records for service furnished in the county. The order was handed down after Metropolitan and Edison Light & Power Co, York, had protested against provisions in a PUC order approving the merger of the two utilities.

The common stock of Consolidated Gas, Electric Light & Power Co of Baltimore will be split, three shares for each present one, if the stockholders approve the action at their annual meeting this month. The more popular price range resulting from the split is expected to make the shares more readily marketable and facilitate future raising of equity capital.

Ohio's Supreme Court has upheld Cincinnati Gas & Electric Co's claim to a 6% return on electric operations. The court denied the City of Cincinnati's motion to set aside the company's rate schedule in favor of lower rates proposed by the city in 1944 and 1946 ordinances. A $2.5-million increase was approved by the Public Utilities Commission last September. The difference between the collected rate and the reduced ones advocated by the city, $5.8 million, which had been impounded, has been returned to the company and added to surplus.

Ohio Edison Co's proposed supplemental rate schedule has been suspended by Federal Power Commission pending hearing and decision. The proposed supplement would increase rates to the utility's wholly owned subsidiary, Pennsylvania Power Co, by $226,613 or 26.6%. A hearing will begin May 15 in Washington.

North America Plans to Merge into Union Electric Co of Missouri

THE CORPORATE existence of North American Co, once one of the nation's largest utility holding companies, soon will come to an end.

The directors have authorized the management to draft a program to merge North American into its largest subsidiary, Union Electric Co of Missouri. Details of the merger, when approved by the board of directors, will be submitted to the Securities and Exchange Commission.

To Exchange Share-for-Share

Union Electric will acquire all the net assets of the parent company, estimated at more than $20 million excluding North American's ownership of Union Electric stock. Each share of North American will become one share of Union Electric common. To make this possible Union Electric's common shares, all of which are owned by North American, will be reclassified into the number of North American's common shares, of which 8,572,626 were outstanding as of last Sept 30.

In 1937, when it registered under the Holding Company Act, North American was the top holding company in a system which controlled 36 utility and 46 non-utility subsidiaries. The consolidated balance sheet of North American and its subsidiaries showed assets of more than $900 million, and through direct and indirect ownership of securities North American controlled an empire whose aggregate value was stated to be about $2,200 million.

Most Holdings Eliminated

Now, in compliance with the act, North American has eliminated all its debt and preferred stock and has disposed of nearly all its assets.

It still has as wholly owned subsidiaries Union Electric, Missouri Power & Light Co, Hevi-Duty Electric Co, and 60 Broadway Building Corp. North American also holds all the common and more than 80% of the preferred stock of North American Utility Securities Corp and has a preferred stock investment in Muzak Corp. Its net liquid assets, including Treasury bonds, are estimated at about $15 million.

Last September North American distributed to its own stockholders all its holdings in Kansas Power & Light Co at an exchange ratio of one share of Kansas P&L for four of North American. In November West Kentucky Coal Co stock was distributed to North American shareholders at one for ten.

Union Electric, operating in Missouri, and its wholly owned subsidiary, Union Electric Power Co, operating in Illinois and Iowa, supply electric service to more than 460,000 customers in the St. Louis and surrounding areas. Investment in Union Electric property and plant was $340,855,000 on Dec 31.

J. Wesley McAfee, president of Union Electric, will remain in that post after the merger, it is understood. No indication has been given of the future status of North American's management, headed by Herbert C. Freeman.

At the same meeting the directors declared a cash dividend of 30¢ a share on the common stock of North American, payable April 1 to stockholders of record March 7.

•

South Carolina E&G Seeks to Absorb S. C. Power

South Carolina Electric & Gas Co, Columbia, and South Carolina Power Co, Charleston, have asked the Public Service Commission for permission to merge. Hearings will begin March 30 at Columbia.

Under the plan proposed South Carolina Power would liquidate and South Carolina Electric & Gas, which already owns all its outstanding stock, would assume all its assets and liabilities. Electric & Gas also seeks to issue $22.2 million principal amount of first mortgage 30-year bonds at interest not to exceed 3¾% to retire bonds now held by institutional investors.

RECENT RATE CHANGES

Hamilton, Ontario, is the first municipality to receive permission from Ontario Hydro-Electric Power Commission to raise consumer power rates following the Commission's wholesale rate boost Dec 20. An overall increase of 13% will add about $548,000 to Hamilton Hydro-Electric System's yearly income. Some 58,000 consumers will be affected.

Bangor (Me.) Hydro-Electric Co has increased the one-cent block in its domestic rates to 1.5¢ a kwhr and the nine-mill block to 12.5 mills in its rate to other utilities. These increases, necessitated by the higher cost of fuel-generated energy, together total less than 1% of electric revenues. Average domestic rates are now 3.25¢ a kwhr compared to 4.3¢ five years ago.

Output Rises Despite Effects of Coal Strike

Despite the coal strike, which curtailed industrial production severely in the Central Industrial states, output rose in the week ended March 4. The total for that week was 5,878,788,000 kwhr, 5.9% above that for the corresponding week of 1949. Then the total was 5,551,611,000 kwhr.

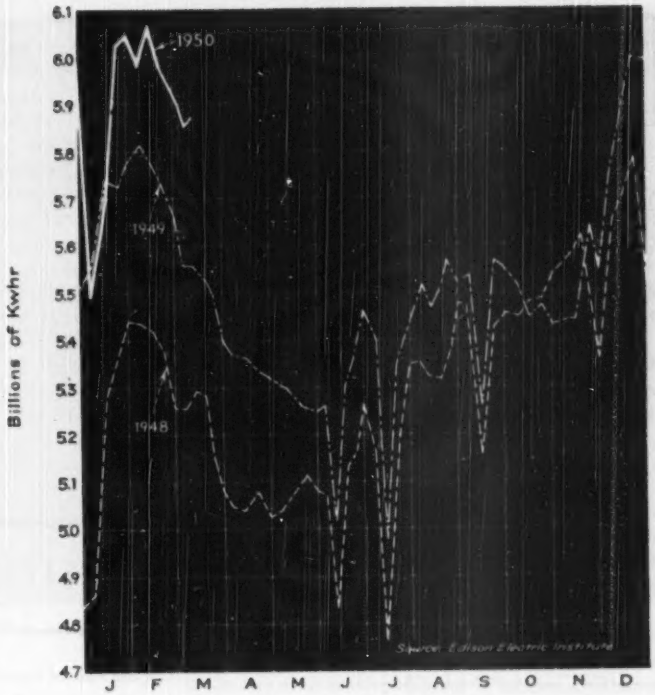
The Central Industrial area in the week ended March 4 was 0.9% below last year. All other areas reported increases. New England led with an increase of 15.6%.

Weekly Output, Millions Kwhr

1950		1949		1948	
Mar 4	5,879	Mar 5	5,552	Mar 7	5,293
Feb 25	5,854	Feb 26	5,559	Feb 28	5,252
Feb 18	5,931	Feb 19	5,650	Feb 21	5,254
Feb 11	5,971	Feb 12	5,722	Feb 14	5,385
Feb 4	6,062	Feb 5	5,778	Feb 7	5,412
Jan 28	5,972	Jan 29	5,810	Jan 31	5,429
Jan 21	6,041	Jan 22	5,769	Jan 24	5,436
Jan 14	6,029	Jan 15	5,727	Jan 17	5,370
Jan 7	5,695	Jan 8	5,742	Jan 10	5,278
1949		1949		1948	
Dec 31	5,493	Jan 1	5,562	Jan 3	4,868

Percent Change from Previous Year

	Mar 4	Feb 25	Feb 18
New England	+15.6	+13.4	+10.2
Mid-Atlantic	+ 5.8	+ 5.8	+ 4.7
Central Industrial	— 0.9	+ 2.1	+ 2.2
West Central	+ 8.1	+ 7.0	+ 6.6
Southeast	+10.4	+ 8.8	+ 6.9
South Central	+10.1	+ 7.1	+11.0
Rocky Mountain	+ 8.0	+ 1.2	+ 1.5
Pacific Coast	+ 6.8	+ 5.5	+ 4.5
Total United States	+ 5.9	+ 5.3	+ 5.0



MEETINGS

National Electrical Manufacturers Association
Edgewater Beach Hotel, Chicago, Ill., March 13-16.

★ **Public Information Program**
Mid-Atlantic Region, Hotel Statler, Washington, D. C., March 14; West North Central Region, Minneapolis Athletic Club, Minneapolis, Minn., March 30; National Meeting, Drake Hotel, Chicago, Ill., April 28.

Industrial Electrical Show
Exposition of Commercial and Industrial Equipment, sponsored by Electrical Maintenance Engineers Association of Southern California, Inc., Shrine Convention Hall, 700 West 32nd St., Los Angeles, Calif., March 15-18.

Edison Electric Institute
Industrial Relations Committee, EEI headquarters, New York, N. Y., March 16, Netherland-Plaza Hotel, Cincinnati, Ohio, April 20; Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., April 4-6; Purchasing and Stores Committee, Schroeder Hotel, Milwaukee, Wis., April 24-26; Electrical Equipment Committee, Edgewater Beach Hotel, Chicago, Ill., May 2-3.

Conference for Protective Relay Engineers
Department of Electrical Engineering, Agricultural and Mechanical College of Texas, College Station, Tex., March 20-22.

Southeastern Electric Exchange
Engineering and Operation Section, Buena Vista Hotel, Biloxi, Miss., March 23-24; Annual Conference, Greenbrier Hotel, White Sulphur Springs, W. Va., April 12-14.

American Public Power Association
Annual Convention, Shoreham Hotel, Washington, D. C., March 28-30.

Missouri Valley Electric Association
Engineering Conference, President Hotel, Kansas City, Mo., March 29-31; Accounting Conference, President Hotel, Kansas City, Mo., May 18-19.

Pennsylvania Electric Association
Communications Committee, Spring Meeting, Lawrence Hotel, Erie, Pa., March 30-31; Industrial Committee, Industrial Power Conference, Bedford Springs Hotel, Bedford, Pa., May 2-3. Transmission and Distribution Committee, Spring Meeting, Alexander Hotel, Hagerstown, Md., May 25-26, Joint Meeting, Traffic Safety Committee, May 26.

★ **National Association of Corrosion Engineers**
1950 Conference, Hotel Jefferson, St. Louis, Mo., April 4-7.

Midwest Power Conference
Sherman Hotel, Chicago, Ill., April 5-7.

American Institute of Electrical Engineers
Conference on Protective Welding, Hotel Detroit Leland, Detroit, Mich., April 5-7; Great Lakes District Meeting, Hotel Hayes, Jackson, Mich., May 11-12.

American Society of Mechanical Engineers
Spring Meeting, Hotel Statler, Washington, D. C., April 12-14.

Northwest Public Power Association
Semi-annual Convention, Davenport Hotel, Spokane, Wash., April 17-19.

American Institute of Electrical Engineers
Power Conference, sponsored by Committee on Power Generation, Industrial Power System, and System Planning, William Penn Hotel, Pittsburgh, Pa., Power Generation, April 19; Industrial Power System, April 20.

Electrochemical Society
Annual Convention, Statler Hotel, Cleveland, Ohio, April 19-22.

Oklahoma Utilities Association
Annual Convention, Biltmore Hotel, Oklahoma City, Okla., May 4-5.

★ **Public Utilities Advertising Association**
Annual Convention, President Hotel, Kansas City, Mo., May 11-12.

New Jersey Utilities Association
Annual Spring Conference, Seaview Country Club, Absecon, N. J., May 12.

Pacific Coast Electrical Association
Annual Convention, Mapes Hotel, Reno, Nev., May 31-June 2.

★ Addition This Week.

Union Electric Co Asks PSC to Realign Areas

The Union Electric Co of Missouri has asked the Public Service Commission to define its service area in four counties. In St. Charles County the utility wishes to confine its service to six eastern townships between the Missouri and the Mississippi Rivers. It would then take over a small portion of St. Charles Township now served by the Missouri Edison Utility Co of Louisiana, Mo. The remainder of the county would then be served by Missouri Edison and the Cuivre River Electric Cooperative.

In central Missouri, Union Electric proposes to realign its services in Miller, Camden, and Morgan Counties by abandoning approximately the western half of its present operating area. Three other utilities and two cooperatives would then serve the abandoned area. Union also wants to serve Brumley in Miller County. The Three Rivers Electric Cooperative is now serving Brumley.

WASHINGTON COMMENT

RONALD D. ROSS

ONE OF THE MOST important pieces of legislation to be enacted into law by the eighty-first Congress may well be that creating a National Science Foundation.

The electric industry, all industry, and everyone, for that matter, may share with scientists the hopes that great future developments will result.

Scientists have been pleading for establishment of the foundation since the end of the war. Now both the Senate and House have passed Science Foundation Bills. And President Truman probably will approve whatever compromise is arrived at between the differing provisions of these bills.

The foundation will promote basic research and education in science, start and support basic research in different scientific fields, and work with the Secretary of Defense on scientific research in connection with defense projects—except for those involving atomic energy.

Tools for these broad operations will include contracts for research, grants, loans, and scholarships. The foundation will foster interchange of scientific information and maintain a register of scientific personnel—a sort of central clearinghouse for scientists and engineers. Special commissions within the foundation will direct its work in different broad fields and perhaps some specific ones, such as attacks on various diseases. The President will appoint a full-time, $15,000-per-year director and the 24 part-time members of a policy-making board.

Don't look for any quick results. It's a long-range proposition. But the possibilities are such that it may be a good investment even if the dividends don't start coming in until the year 2,000. Big talking point for the foundation boosters is that it will promote basic research.

The point is that basic research tends to be a virtual flight into the unknown. There may be a pot of gold at the end of the rainbow, but one has to go there to find out. The twin risks of really basic research—the chance, even probability, of not getting where one wants to go, plus the possibility of not finding anything when he gets there—make it a poor investment for most industries. For this reason, American scientists since the war have urged pretty generally that the government support pure research.

Urgency is pleaded because of the wartime science effort, which took the research of decades, and even centuries, and turned it into machines. Today, we are told, we are running out of the stuff on which great technological advances of the past 50 years were built.

Today's electric industry owes much to men like Edison, but he built on such things as the curiosity of a kite-flyer named Franklin and other less known heroes who were interested in an invisible force which man now calls electricity. We'll have no more Edisons until we have some more "kite flying," the scientists tell us.

Agreeing with the scientists, the question remains whether a National Science Foundation will, in effect, "go fly a kite." Or will it be another "rathole" in a sieve-like federal budget, a bureaucratic nose poked through the doors of private research laboratories or a tax-supported agency which scientists can use to tell other scientists how fine it is to be a scientist?

Improperly or inefficiently administered, the foundation could waste huge sums, interfere with established research programs, or simply add another name to the vast roster of scientific bodies.

Much of the answer depends on the choice of the director, who will have broad discretion in organizing the foundation and its work. But, in addition, success or failure will hinge on the cooperation of interested nonscientists, who must work with the foundation if they are to profit from its work.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Coal can be stored by mobile equipment twice as fast as with locomotives and cranes and at half the cost per ton and half the personnel.

Secondary network cable is 87% in ducts and 13% buried, but the latter is almost entirely in foreign cities.

Rubber-lead, non-leaded and paper, stand in mileage preference in the ratios 41, 26 and 18.

Air removal in condensers is superseding the use of deaerating heaters in the high pressure steam generating stations.

Outage hours have been 4 to 6 times as long for turbines as for generators, and some 22 times as long as for condensers.

Impulse strength of transformers was practically doubled from 1920 to 1940, largely by eliminating impulse creepage surfaces and by excluding entrapped gas from the insulation.

Relaying considerations favor resistance grounding for generator neutrals; reactance grounding results in wider range of ground-fault currents when number of operating generators is varied.

Split-type current transformers ought to be equally handy and nearly as acceptable accuracy-wise on existing buses as for sampling measurements.

EXPERIMENTAL DESIGN for the street-lighting fluorescent luminaire shown here takes two or four 96-in. T-8 lamps or two 96-in. T12's

What of Fluorescent Street Lighting?

Summary of progress so far indicates that fluorescent has promise of reaching practicality for street and highway use. Read this article to learn what work must yet be done

J. P. RUTHERFOORD
General Electric Co, Lynn, Mass.

EXPERIMENTAL fluorescent street lighting installations in Detroit, Cleveland, and Schenectady have been studied carefully by illuminating engineers during the past eight years. From these studies they have concluded that fluorescent lamps have several advantages, and also several disadvantages, for street lighting.

Briefly, the studies showed:

1. That the advantages include relatively long life, low brightness, high efficiency of light generation, and enhanced visibility on wet pavements due to the broad streaks of brightness from an elongated source positioned across the pavement.

2. That the disadvantages include inherently low output per foot of source, the large size of the luminaires, and the need for "jacketing" in cold weather to assist in maintaining light output.

3. That, with the lamps and luminaires presently available, fluorescent street lighting provides lower visibility in relation to cost than is now obtained with other light sources.

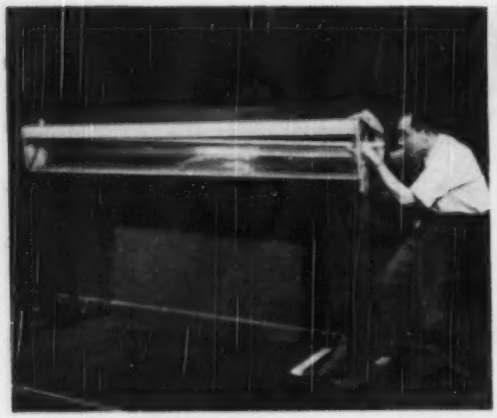
4. That fluorescent street lighting offers opportunities for novel and interesting effects.

5. That fluorescent lamps are likely to find their earliest roadway lighting applications in tunnels, underpasses, and other locations where structural features permit the ready mounting of the elongated luminaires.

To compare the costs of incandescent and fluorescent street lighting is as inconclusive as comparing the costs of transportation by motorcycle and automobile. If you must have transportation, you'll take a motor-cycle if you can't afford an automobile.

And so it is with street lighting. We feel that there is not enough money available to light our streets properly under present day conditions, so we concern ourselves with first cost and maintenance as the criterion of comparison.

This is not a criticism but a statement of fact. Fluorescent lamp street lighting is expensive, we know. The fixtures, the lamps, and the poles and brackets all cost more per unit than the same lumen size incandescent installation. Because the fluorescent fixture is so large it will be subject to more maintenance expense also.



BROAD LATERAL DISTRIBUTION of light is furnished by long linear unit designed for low mounting as on bridge or fence rails

FOR LOW CEILINGS of tunnels and underpasses, this unit is designed for good lighting effectiveness in continuous row mounting

Fluorescent street lighting in this country cannot, therefore, be justified economically if it must be compared cost-wise with code* quality incandescent street lighting.

If we knew enough about visibility and how to evaluate it, we might then, by using as a base some standard level of visibility, compare the economy of fluorescent versus incandescent street lighting with more favorable results for fluorescent. But that is a big "if."

Two Improvements

We know that for a given brightness level on the pavement above some minimum value we can, with fluorescent, produce visibility far superior to the best conventional methods of lighting streets with incandescent. Fluorescent grants two improvements to seeing conditions now prevalent on our best lighted streets today:

1. A more comfortable low brightness source.

2. A broader brightness pattern on the pavement, particularly under wet pavement conditions.

From studies reported by Matthew Luckiesh, S. K. Guth, and L. L. Holladay, it is indicated that comfort improves as source brightness decreases, while the brightness of the visual field remains constant. This tells us that for a given brightness distribution in the driver's field of view he might expect to have his comfortable seeing improved as the source brightness decreases. These three men have made other studies which show that for a given source brightness comfort decreases as the size of the source increases. This relation, however, should not concern us too much in our appraisal of fluorescent street lighting, because the difference between the source brightness of fluorescent and incandescent has a far greater effect on the comfort of the motorist than does the difference in physical size of the source. Speaking of size, it is interesting to note that in their report to the National Technical Conference of the Illuminating Engineering Society, held Sept. 20-23, 1949, Luckiesh and Guth showed a table of source size versus brightness for circular and linear sources for a given degree of comfort which they designate as BCD (sensation at the borderline between comfort and discomfort). This table shows a slight advantage in comfort for the linear source over the circular source of the same projected area.

Just how much effect source brightness has on comfortable seeing under a street lighting installation is still unknown, but evidence is conclusive that larger low brightness sources do materially improve comfortable seeing and reduce fatigue.

The other benefit to good visibility produced by fluorescent, the broader brightness pattern on the pavement, is one for which the experts have been striving for years.

The eight-foot-long fluorescent luminaire produces a broad area of brightness on the pavement almost as wide as the standard automobile under the worst conditions of pavement specularity. This is a feature that makes the fluorescent street light mounted transverse to the flow of traffic "a natural."

Forward-thinking public and electric utility officials are seriously considering large scale experimental installation of fluorescent street lights. Studies of these pioneer installations should provide the industry with invaluable service data on which plans for future modernization with fluorescent can be based.

One of the unknowns to be sought after by these pioneer installations is the effect of ambient temperature on the efficiency of the lamps. Cold room tests cannot faithfully reproduce the effect of cooling winds. It is only thru trial and error that we can determine how much, if any, compensating provision will be required.

The street light, the bridge railing light and the tunnel or underpass fixture, illustrated here, are all totally enclosed. Preliminary checks indicate that for temperatures down to the freezing point outside the fixture, the tube wall temperature of the lamps will stay up in the range of best efficiency. The effect of lower temperatures and chilling winds will have to be checked in a number of different locations under varying conditions. Another influence to be

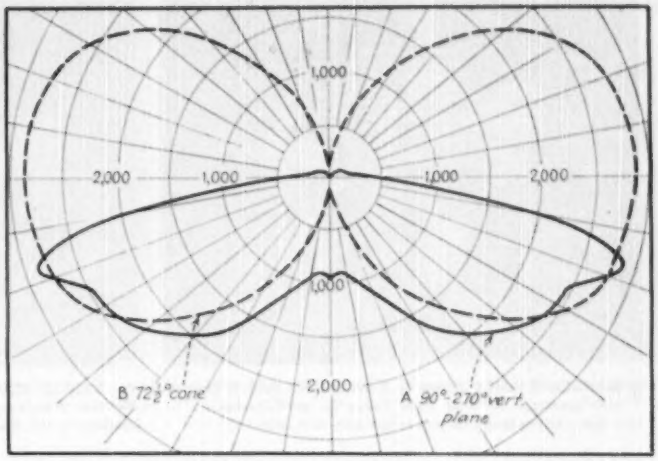
* Illuminating Engineering Society Code of Recommended Practice as adopted by the American Standards Association as American Standard Practice.

studied is the effect of high ambients on the efficiency of the lamps. If the tube wall temperature of fluorescent lamps exceeds the ideal operating temperature, then the efficiency drops off just as it does below the ideal temperature.

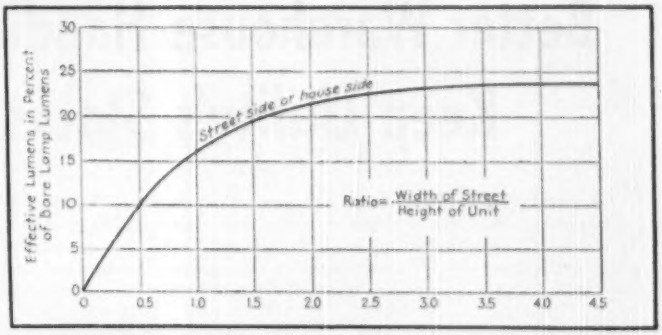
A scheme for compensating for the effect of low ambient temperatures on the output of the lamp has been worked out for tunnel installations. One notable installation now nearing completion is the Battery-Brooklyn Tunnel. In this system the lamps are operated in series at 50 ma normal and at 150 ma when compensation for low ambient temperatures is needed or at 450 ma when extra brightness levels at the portals are required on bright days.

The street lighting fixture is designed to take either two or four 96-in. T-8 lamps or two 96-in. T-12 lamps. Preliminary photometric data indicate a markedly better utilization of bare lamp lumens of the T-8 lamp than of the T-12 lamp. This may lead to the eventual more popular use of the two and four T-8 lamp combination than the two T-12 lamp arrangement even though at design current the T-12 lamp delivers more lumens than the T-8 lamp. This prognostication may be reversed after more experience is gained with various combinations.

Photometric distribution curves above were taken with the street light illustrated equipped with two 96-in. T-8 lamps. The utilization curve shows the efficiency on the street surface to be rather low when compared with modern incandescent fixtures. Part of this is due to the large proportion of the total light output directed to the sidewalks and building fronts by the two-way distribution.



PHOTOMETRIC DISTRIBUTION curves, experimental luminaire with two 96-T-8 lamps



UTILIZATION EFFICIENCY of experimental street lighting fluorescent luminaire apparently approaches limit of 25%, much lower than modern incandescent fixtures. Luminaire has aluminum reflector, clear plastic cover, and four 96-in., 4,500 K white, T-8 lamps

Improving Surface Efficiency

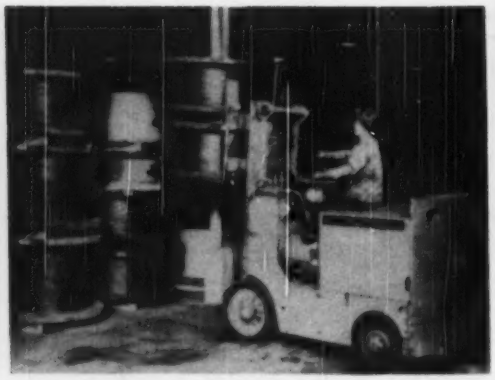
This condition can be improved by constructing the fixture housing with a divergence of approximately 30 deg between lamps. This produces a toe out of the two beams of approximately 15 deg laterally. Utilization efficiency is improved 8 to 10%.

The low mounted bridge and fence rail lighting unit produces a somewhat similar but undirectional distribution. The application of this fixture is on bridge railings where for architectural reasons high poles and mounting brackets are not wanted or on fence railings along thoroughfare sections through airport runway approach zones where normal mounting heights for the more ideal overhead lighting are not permitted.

The broad lateral spread of these low mounted lights and the long linear shape of the source resolve some of the more serious objections illuminating engineers have had to so-called parapet-type lighting, provided they are mounted close together in a continuous line and preferably on both sides of the roadway.

The tunnel and underpass type of fixture has gained immediate acceptance, because it can be mounted in a continuous line overhead on a low ceiling with very good lighting effectiveness. Fixtures in short underpasses probably will be operated from conventional 120-v, 60-c service. In long underpasses and tunnels the added flexibility and the constant current of series connection will generally call for such operation. Here current through the lamps can be controlled by a photoelectric relay which will automatically change the current to compensate for changes in ambient temperature.

The fluorescent era of street lighting is just beginning to bud. Many unknown factors relating to its practicality and to its acceptability will be explored in the next few years so that a prediction today as to the extent of its eventual use in this country is purely crystal-ball-gazing. This writer has confidence that our technological know-how will continue to progress as it has in the past so that as obstacles to the use of fluorescent are uncovered, ways around them will be discovered or invented.

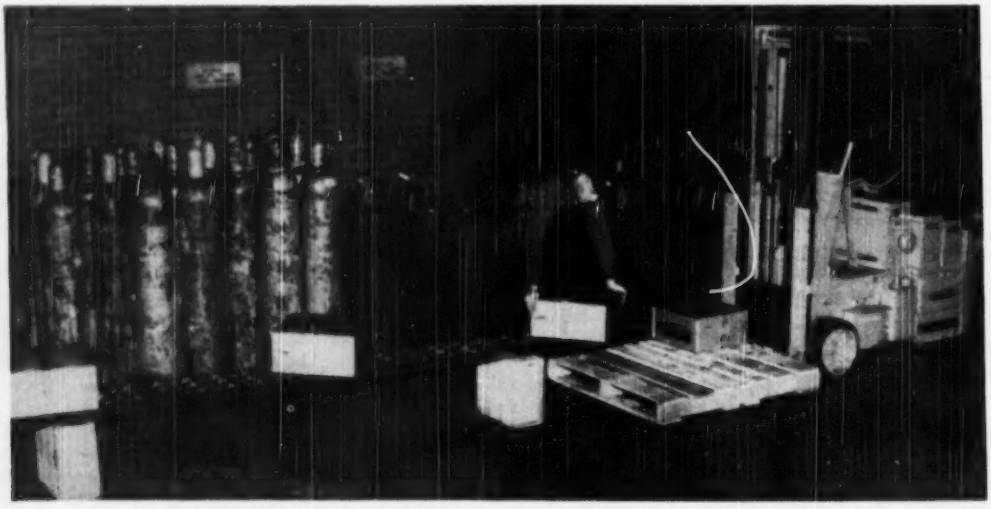


1 HANDLING REELS of wire by 2 ton fork lift truck in the central warehouse of West Penn Power Co at Connellsville, Pa. This type truck enables one man to tier coils 14 ft high

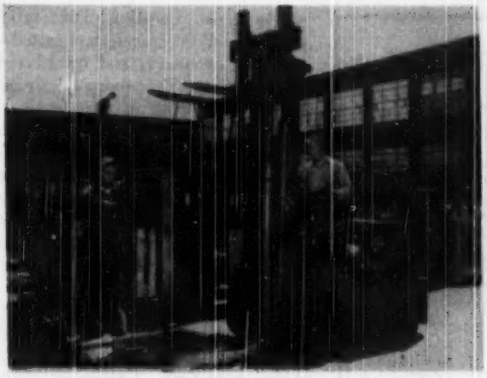
2 STORED EQUIPMENT is located according to convenience, time in storage, weight, and alphabetical-numerical arrangement. Handling is with hand-lift or 1 of 7 battery-powered fork trucks

Better Warehouse Handling Methods Keep Utility's Stocks Moving

How West Penn Power Company's expanded fork-truck-pallet-system, using battery powered trucks, and existing crew of 17 warehousemen, handles 4,400 different articles and equipment at the Connellsville Pa., warehouse, where more than a million pounds are moved every month to 36 district warehouses and power plants serving an 8,700 sq mile area. Fork lift trucks enable one man to pick up, carry and put down loads without assistance and make warehouse work as attractive as other jobs, both from standpoint of minimized labor and employee prestige

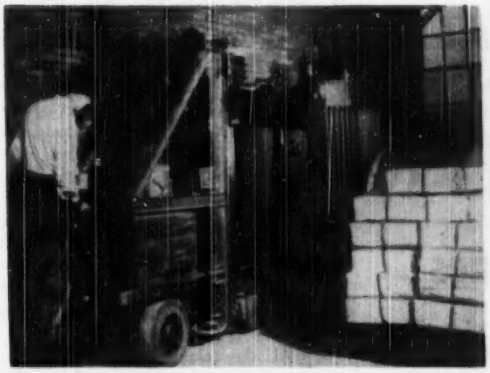


5 INCOMING SUPPLIES AND EQUIPMENT are generally palletized on arrival either inside the freight cars or on the truck docks. And the unit loads are moved directly to designated storage areas by fork truck. The average length of such hauls is about 60 ft inside and about 25 ft outside the warehouse. Picture shows a roller "skate wheel" conveyor moving supplies to a truck

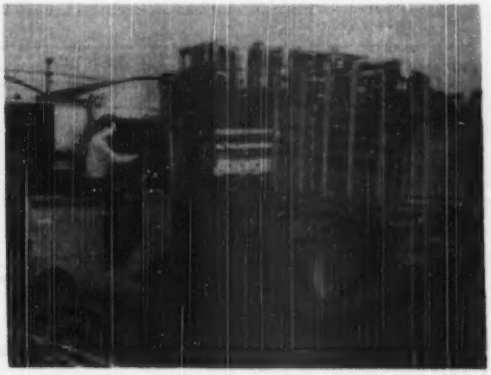


3 **CRATED TRANSFORMERS** are unloaded by sling or truck fork, then stored on pallets. Crates of smaller distribution transformers are bound together with batten strips supporting them

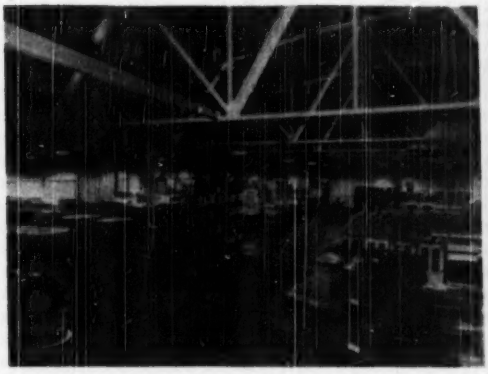
4 **PALLET BOXES AND "RINGS"** contain small, irregular articles. "Rings" are rectangular inclosing fences shown on the hand-lift trucks. Extensions of the steel corner angles hold rings



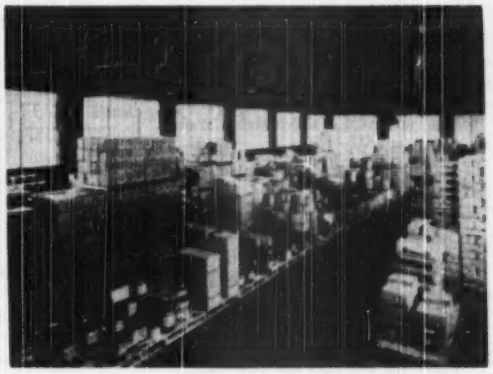
6 **FIRST LIFT TRUCK** purchased by West Penn, after 22 years of service, positions a 6,600-lb transformer in warehouse corner. At right can be seen a skid load of unassembled coat lockers



7 **PALLET BIN** of lightning arresters consisting of two interlocking "rings" make last unit load on outgoing trailer load. Hydraulic lifting end gate will be used to unload the equipment



8 **ALL-STEEL WAREHOUSE** for storage of heavy materials in carload lots has unlimited floor loads and the lift trucks can tier to 14-ft height. Storing and dispersing is usually done by two men



9 **SECOND-FLOOR WAREHOUSE** has 4 rows of palletized supplies. Allowable load prevents full utilization of overhead space. Three story brick building has 42,800 sq ft of concrete floor

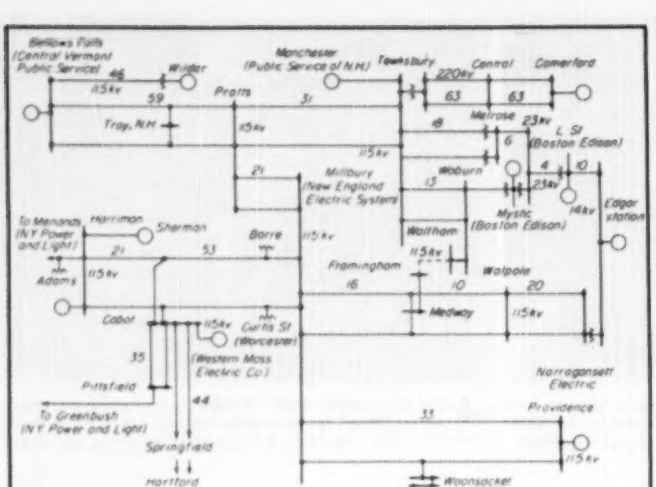


FIG 1—CARRIER RELAYING with a coded signal was installed initially on first tie between Tewksbury and Melrose on 115-kv transmission system of New England Electric System

Carrier Relaying Aids 115-Kv New England Tie Lines

Operating records indicate high ratio of successful performance

HERBERT L. GOODRIDGE
Assistant Engineer
New England Power Service Co
Boston

CARRIER relay protection of transmission lines of the New England Electric System has attained a valued place in our relaying practice. Minimum interruption of customer service has become more and more vital. Graded time delay relaying is no longer adequate. Carrier relaying has permitted strengthening of interconnections and transmission of larger blocks of power without most of the limitations of other types of relaying. A condensed review of application problems encountered as the New England Electric System has grown in recent years, and of our solutions of these problems, may be significant.

First installation on our system was made when an 18-mile gap between Tewksbury and Melrose was closed (Fig 1). At Melrose, two 25,000-kva transformers stepped the 115-kv from Tewksbury down to 23 kv. This strengthened the connection to Boston Edison and gave the North Boston system greater benefit of hydro power from our own system. No oil circuit breakers were provided on the 115-kv tie at Melrose, and a ring type 23-kv bus was installed.

Without 115-kv switching at Melrose, proper transformer protection could not be had with overload or distance relaying only. Balanced relaying could not be used with the initial single circuit installed. Differential protection of the transformer installation was necessary, and transferred tripping of the Tewksbury oil circuit breaker was required. Therefore carrier with a coded signal was selected.

Under certain generating conditions the important Malden-Melrose area would be in the electrical center of the system and subject to tripouts on out-of-step or heavy load swings. Tripping outside this area, preferably on the ties to Boston Edison's L station, was most desirable. This called for blocking Malden-Melrose and Melrose-Tewksbury relays during out-of-step conditions. Carrier or pilot wire connections were necessary.

Pilot Wire or Carrier

Malden-Melrose could be handled with pilot wire cable, some of which was already in use for supervisory control. Carrier pilot was more economical for Tewksbury-Melrose. The requirements for back-up and pilot protection were best met by distance relaying for phase-to-phase protection. Instantaneous pilot wire ground relays were used, with separate time delay backup. The high cost of this relaying was warranted by the elimination of one 115-kv oil circuit breaker alone. A second 115-kv circuit has been added and additional cable capacity is planned between Melrose and Malden.

All the relaying for the ultimate installation was purchased at the same time, enabling the set-up to be given better factory tests than could have been made in the field. We used the additional relays to advantage (prior to erecting the second Tewksbury-Melrose circuit) on some of our less important ties between Melrose and Malden.

The relays in this set-up are of the directional comparison type. Each single-phase relay includes an inductor loop directional element, three beam-type impedance elements for the three distance zones, and a synchronous timer with two contacts for second and third zone backup time delay. The ground relay has an inductor loop directional element, carrier starting beam, and tripping beam. The power transformers are solidly grounded on the 115-kv side and through a common reactor on the 23-kv side. Current transformers in these neutrals are interconnected to

From an address before the Technical Group on Transmission, Boston section, AIEE.

provide polarizing current for the directional ground relays. The resultant current is equivalent to the current in the delta tertiary.

Out-of-step blocking is obtained by an auxiliary relay operated by the third zone elements of the impedance relays. When all three third zone elements operate, a pendulum relay picks up a slugged auxiliary in about seven cycles. When the directional elements and the Zone 2 elements at both ends close, the receiver relay de-energizes the pendulum relay and it starts to reset. If the Zone 2 elements have not reset before the pendulum relay resets, tripping is permitted.

Tewksbury-Melrose is a steel tower line, rather than wood, to satisfy municipal requirements at the time. Lightning tripouts on this line have exceeded expectations considerably. These were probably due to steel tower construction and in some sections to poor grounding conditions.

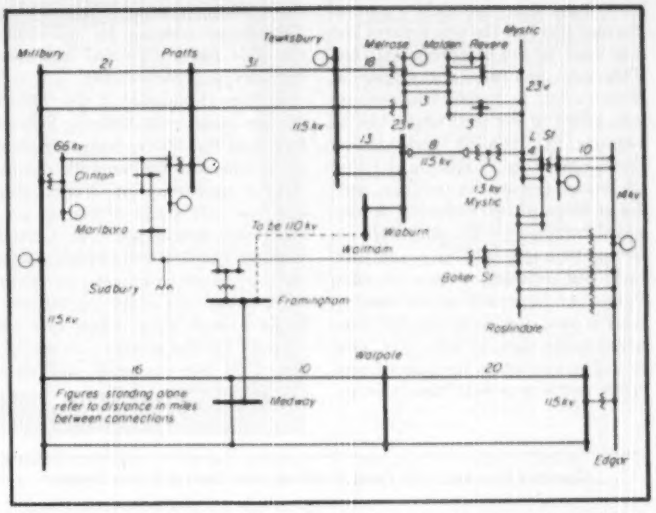


FIG 2—FAST RECLOSING on Millbury-Boston Edison connections prompted use of carrier relaying to insure the simultaneous tripping of all terminals on the connecting lines

Relaying Other Ties

Increasing prospects of load transfers between Millbury and the Boston Edison Edgar station (Fig 2), with rising generating capacity on the Edison system, called for better relaying and automatic reclosing on these lines. Extremely high-speed reclosing was needless, as the North Boston ties would hold for at least 2 sec. One-second reclosure was cheaper due to lower costs of rebuilding oil circuit breakers. This was also desirable because of possible cascaded tripping of the three-terminal Walpole - Medway - Millbury section. Balanced beam impedance relays and ground relays were also used, with reclosing when tripped by carrier relays. Since it is essential that all terminals be simultaneously tripped, carrier relaying is necessary where fast reclosing is used. No out-of-step blocking has been used on these lines.

On the Millbury-Providence 115-kv line shown in Fig 3, a tap installed at the approximate mid-point called for carrier relaying in order to maintain the former degree of stability. This was accomplished with the reactance-induction cup type of relay, with a separate impedance relay for starting carrier. Equipping this line with carrier presented a unique problem. There was a section of 115-kv cable at the Providence end and a third terminal at Woonsocket. Cascaded tripping could be expected when ground faults occurred near either end. To minimize the delay, instantaneous ground relays were installed at Millbury and Providence. The cable is protected with a phase-comparison pilot wire relay, backed up by the carrier relaying covering the whole line. This phase comparison relay is simple in application; requires little maintenance, but does call for independent backup relaying. In this case it was provided at no additional cost. As it is difficult or impossible to transmit radio frequencies through a line consisting of part cable and part overhead, the carrier radio was installed at the cable terminal and controlled by pilot wires from the Franklin Square substation 2.27 miles away in downtown Providence.

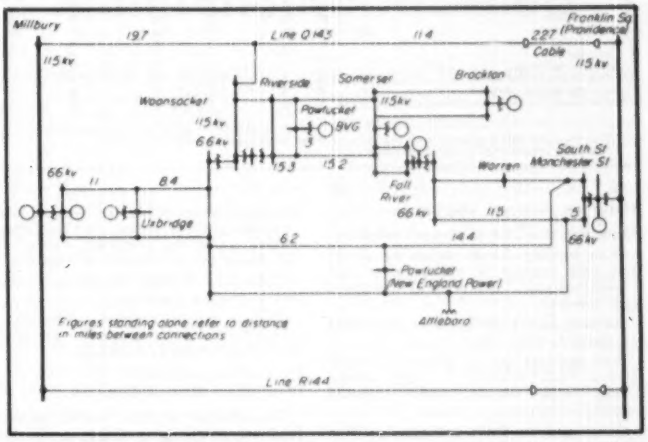


FIG 3—PILOT WIRE relay of the phase-comparison type protects cable on Millbury-Providence connection of New England Electric System. Carrier relaying covers entire line

Tie line load increase required a second 115-kv circuit between Millbury and Franklin Square. Stability requirements called for carrier relaying and high-speed reclosing (20 c). Polarm wood construction was used. Due to physical considerations the

steel tower line was made a part of the new line and the new Polarm line was used in the three-terminal line. This new line was not tapped at Woonsocket. A buried counterpoise was added to the steel tower line to improve its lightning performance. Similar relaying to that on the first tie line is used on the new one, with the addition of fast reclosing. A tone signal initiated by the pilot wire relaying trips the Millbury end and locks out reclosing in case of cable failure. An improved carrier starting relay is used. Reclosing has also been added to the three-terminal line. This is a 35-c operation because of cascaded tripping possibilities. No reclosing is provided at Woonsocket. Transferred tripping by audio-tone on cable faults trips and locks out Millbury and Woonsocket.

In New Hampshire, a new 115-kv tie has been built between Bellows Falls and the Wilder hydro development. Intended for use with the increased generation at Wilder, this line was built ahead of time to provide more firm capacity to Central Vermont Public Service hydro system and to relieve overloads on 44-kv lines. It has carrier relay protection. While the new "mho" relays were not required for this 46-mile line, the difference in cost was small, and their use advantageous. Reclosing is not justifiable. Wilder has no 115-kv oil breaker. Transferred tripping is required for transformer differential protection.

Because of increases in capacity of Boston Edison's Mystic station and a new steam plant scheduled for Salem Harbor, Pratts-Millbury and Pratts-Tewksbury double-circuit 115-kv lines may have to carry over 200 Mw. This heavy loading makes carrier relaying and fast reclosing desirable. While the lines are short (21 and 31 miles) the heavy loading also makes the "mho" relay attractive.

In this table "correct blocking" operations were estimated by assuming all operations of 115-kv lines connected to the station bus required carrier blocking. This is not quite true, but is partially balanced by 66-kv and 23-kv operations which were not counted but may have called for blocking on the carrier lines.

Operating Experience with Carrier Relaying—New England Electric System

Operation	Line Designation						
	T146* T146 Melrose-Tewksbury		S145	C129 D130 Millbury-Walpole		Q143 Millbury-Providence	R144
Years experience carrier relaying	2	12	9	3.5	3.5	5	2
Correct tripouts	11	26	20	5	14	2	0
Correct blocking	30	131	86	66	58	81	20
Years reclosing experience	....	....	....	2	2	2	2
Correct reclosures	....	....	....	1	8	0	0
Incomplete reclosures	....	....	....	2	1	0	0
Pullouts due to failure to block	2	3	5	0	0	1	0
Pullouts not due to carrier relays	1	4	2	0	0	2	7
Tripouts caused by carrier equipment	3	3	0	0	0	0	15

* First two years before second circuit was built. Second column includes the first two years.
S 145 is the second line, Tewksbury-Melrose.

Notes on Incorrect Operations

Lines S145 and T146 (Melrose-Tewksbury)

Two tripouts due to sensitivity of carrier code receiver to signals other than transmitter code. Remedied by changes in code receiver.

Tripout due to insulation breakdown of a carrier receiver relay.

Five pullouts due to failure of carrier ground fault detector to start carrier. Cause—contact trouble; remedy—installed improved contacts.

Three pullouts due to transfer of ground current between the two transformers at Melrose, caused by use of common neutral reactor on 23-kv side. This occurred only with the unusual switching set-ups. Remedied by adding fault detector in the combined neutral-to-ground connection.

Pullout on Zone 1 at Melrose, unexplained.

Pullout on backup due to failure of relays on another line.

Pullout due to improper mechanical balance of one Zone 3 beam. B-phase beam did not operate on heavy load swing; A and C phases did. Out-of-step blocking therefore unsuccessful.

Pullout due to arcing of Zone 2 contact on resetting after blocking operation. A condenser was added across this contact.

Six pullouts due to simulated residual current when breaking a parallel with an air-break switch. As the 115-kv lines were not tied together at Melrose, current could flow through the neutral current transformer, supplying polarizing current for the carrier ground directional element.

Pullout on backup directional ground due to too low a setting.

Pullout due to incorrect connection of transformer differential-current transformers during construction period.

Lines C129 and D130 (Millbury-Medway-Walpole)

Unsuccessful reclosure due to defective reclosing relay and a defective potential device.

Two unsuccessful reclosures apparently due to cascaded tripping and reclosing before all terminals had tripped.

Lines Q143 (Providence-Woonsocket-Millbury) and R144 (Providence-Millbury)

Pullout on time delay at Woonsocket and Millbury due to improper setting on other lines.

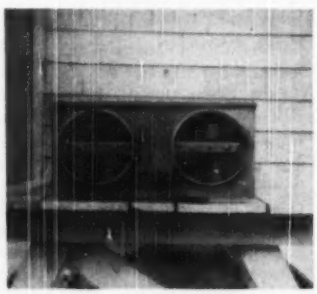
Pullout of Q143 at all terminals due to grounded secondary cable of neutral current transformer at Millbury.

Pullout on time delay due to closing out of phase at Millbury. Two pullouts due to defective distance relay at Millbury.

Seven pullouts due to defective backup directional ground relay at Millbury.

Thirteen incorrect tripouts due to defective tone receiver tubes at Millbury.

•

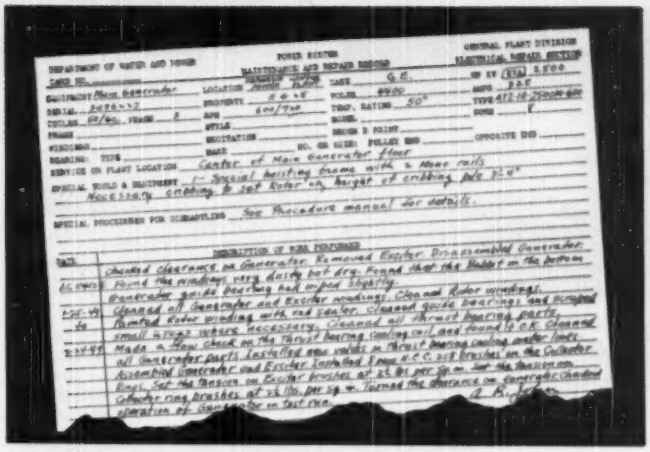


TWO GANG TROUGH plugged into standard socket to hold customer's meter and a check meter so that a comparison check can be made by the customer at any time

Plug-in Trough Aids In Complaint Testing

J. E. BURNEY
Supervisor of Meters
Alabama Power Co
Birmingham

On a scattered system, where complaint testing is expensive, complaints are handled satisfactorily by local personnel using a two-gang trough which plugs into the standard meter socket. Trough has two plug-in sockets which connect customer's meter and a check meter in series. In this way, a comparison check can be made over a given period. Also, the customer can compare his meter with the check meter at any time.



MAINTENANCE AND REPAIR record card is basis for detailed maintenance procedure manual assembled for major electric, hydro, and steam equipment, saving up to 20% in man-hr

Contents of Procedure Manual

- Brief description of equipment
- Clearances; where to be taken
- Precautions to make equipment safe to work on
- Number and class of workmen
- List of tools and equipment
- Advance shop preparations
- Detailed dismantling procedures
- Methods of protecting equipment such as pipe ends during job
- Segregating parts for ready availability during reassembly
- Protection of floors and building
- Methods for anticipated repairs
- Assembly methods
- Return to service
- Cautions on borrowing tools
- Check-up of tools when leaving job
- Completion of record card on job
- Photographs or sketches of how job was done; attaching slings for lifting, etc.
- Safety rules and precautions
- Remarks for future guidance

Standardized Maintenance Manuals

CLAYTON M. ALLEN
Engineer in Charge of
General Plant Division
Los Angeles Dept of Water and Power

MAN HOURS are saved and outage time reduced, by standardized and carefully detailed procedures for recurring maintenance work on the Los Angeles Department of Water and Power system.

Maintenance procedure manuals are based on actual experience with major electric, hydro and steam equipment and savings in man hours as high as 20% have resulted. Other benefits are: (1) Continuing availability of information formerly retained in the heads of those doing the work; (2) increased interest and cooperation of workmen who understand their part of the job; (3) careful planning for the exact materials and equipment required for a job.

Development of Manual

Basis of information for the manual is the maintenance and repair record shown. It is filled out in duplicate by the foreman on the job, and one copy filed in the engineering section of the general plant division. It serves as a permanent record for the individual equipment, and as a guide for repairs or maintenance on identical equipment. This latter function has been expanded into the maintenance procedure manual for large complicated units.

First draft of the manual is prepared in the form of a comprehensive report on maintenance procedure by the foreman who is assigned to the job. This report is approved by the foreman in charge of his section, the shop superintendent of the maintenance, repair and shops section, and finally by the engineer in charge of the general plant division. The manuals include information shown in the box. They are distributed to the foreman, superintendent, and engineer in charge of the division. During later overhauls they are revised. A supplementary report is made at the same time by the engineering section. For more general distribution it covers such items as time and duration of outage, general description of the work and complete information to facilitate references to details, including costs, man hours, recommendations for future work and design changes.

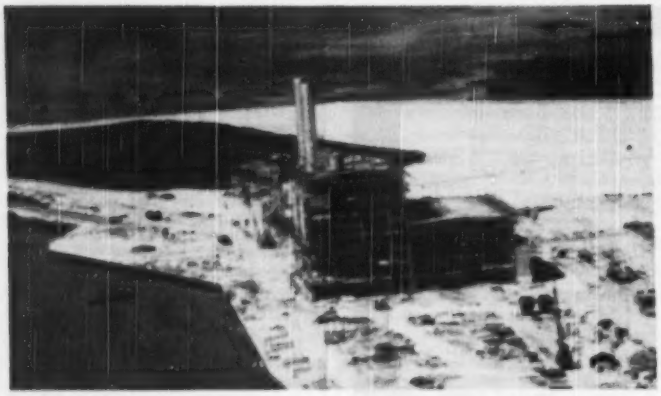
A specific example of the value of the manuals is the overhaul of Hoover power plant hydroelectric generators N-3 and N-4. Unit N-3 was completely dismantled, overhauled, and reassembled in March 1947, with 9,034 man-hours. From the information and experience gained and used to make up a procedure manual, unit N-4 was dismantled and overhauled the following June with only 7,040 man hours—1,994 less.

Similar experiences show a definite direct saving in labor, which increases with increasing size and complexity of the equipment. Also large savings have been effected by avoiding repetition of planning and layout of work. A few of the secondary benefits from use of the manuals are uniformity of work on similar jobs, consolidated and consistent records of wear and replaced parts, and items to watch for on subsequent overhauls.

Everyone from the first level foreman up through the organization has taken great pride in their careful preparation and complete utilization.

Other Applications

In addition to the manuals for electric hydro and steam equipment maintenance, it is a division policy to establish procedure manuals for all its activities—procurement, servicing, automotive and construction equipment fleet servicing, maintenance and repair, stores and warehouses, and clerical and engineering forces.



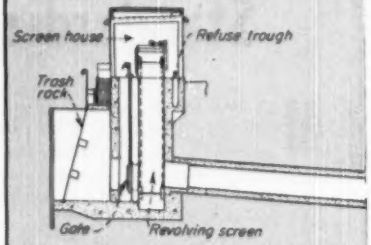
COBB STATION from the air during construction. Muskegon Lake in background is navigable from Lake Michigan for coal delivery; river to left. Substation is at right

Reliability Plus Economy Of Space, Cost and Operation Marks B. C. Cobb Station

Cost is $128 per net kw. Building space is ample with 23 cu ft per kw. Direct connections of plant power supply and generator bus lead to safety economical operation, low cost, and space savings

B. C. COBB STATION DESIGN FEATURES

1. B. C. Cobb station has two 60,000 kw turbine generators now in service. Unit system is modified for greater flexibility.
2. Forced and induced draft fans are installed above steam generators to conserve plant heat losses and reduce duct work.
3. Arrangement of auxiliaries in basement pump area provides clear aisles and ample working areas.
4. Wind bracing and support for the stacks are incorporated in the building structure. Structural design is closely coordinated with the arrangement of equipment.
5. Location of fans, pumps, station electrical supply, main control room and step-up transformers are planned for direct connections. The control room extension permits conduit entrance without passing through main plant walls.



IN CROSS SECTION the central location

CLOSE COORDINATION of the structural, mechanical and electrical designs for B. C. Cobb Plant of Consumers Power Co has resulted in a significant economy of space requirements and substantial savings in investment. Functional arrangement of the equipment for direct piping and electrical connections contributes also to the efficiency of operation and maintenance. Reliability has been increased by the elimination of all items that are not necessary for safety or essential to economical operation.

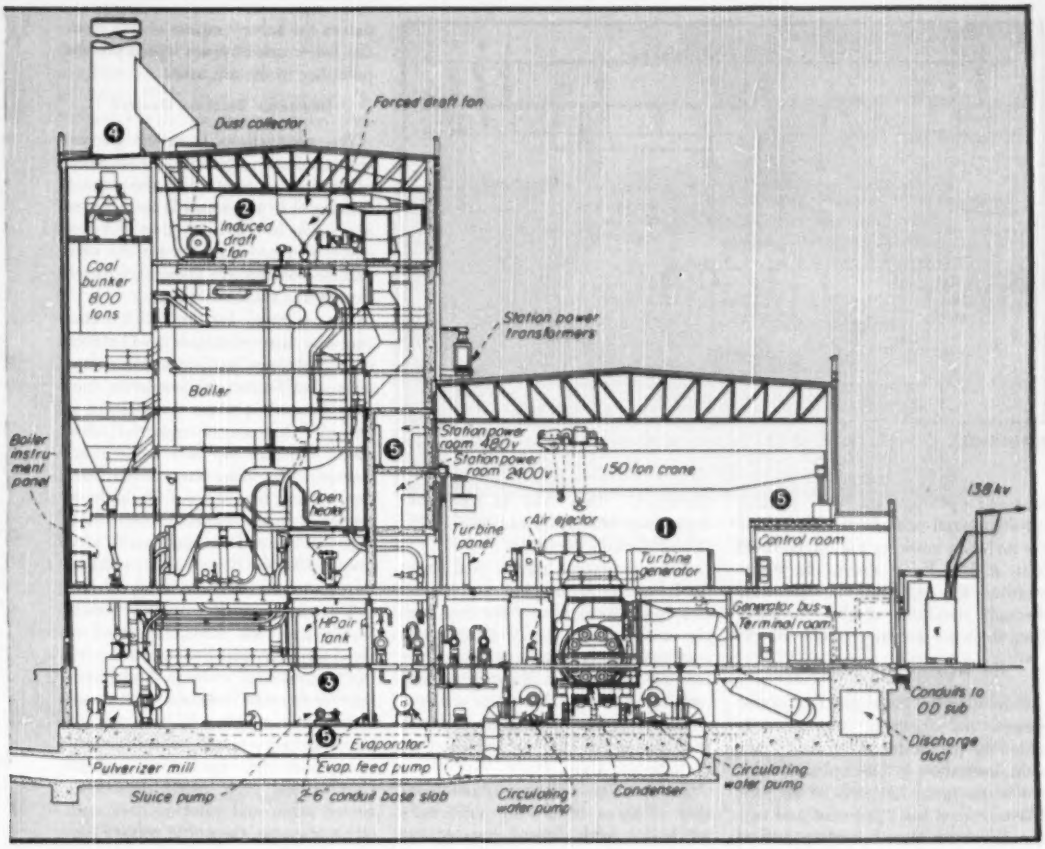
Designed by Commonwealth Services Inc,* this plant includes numerous features which have proven satisfactory in other plants of the former C&S system. It is of moderate size, with two 60,000-kw turbine generator units now in service and with an additional unit being installed for operation in 1950. The design is based on a possible ultimate capacity of 360,000 kw.

Cost of the three-unit installation, including a coal handling system for the ultimate plant, is expected to be approximately $128 per net kw of name plate rating to the 14.4-kv step-up transformer. Average performance for the first six months of operation of two units has been 11,138 Btu per net kwhr generated, with an average station load factor of 0.727 during this period. A total plant personnel of 80 handles all operation and maintenance. Adequate operating room is provided with a space requirement of 23 cu ft per kw, with all boiler equipment and auxiliaries totally enclosed in the building.

One boiler is used for each of the hydrogen cooled AIEE-ASME standard turbine generator units and each generator normally supplies power for its own auxiliaries. The unit system is modified, however, with common main steam and feedwater supply headers for all units. This arrangement of auxiliaries, with a transfer bus for station power supply, provides maximum flexibility in operation and permits taking major equipment out of service for maintenance with a minimum loss of plant capacity.

Steam generators are of the three-drum, bent tube type equipped with steam washers in the rear steam drum and each is rated at 600,000 lb of steam per hour. Tangentially fired furnaces with tilting burners are designed to permit adjustment above and below the neutral position to

* Formerly Commonwealth & Southern Corp

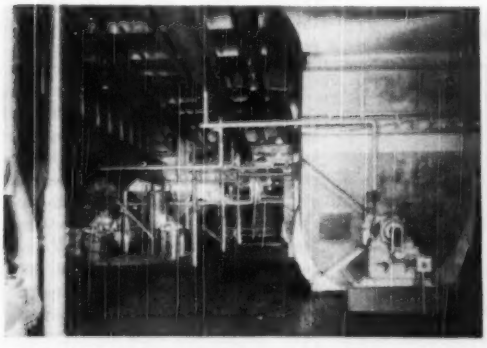


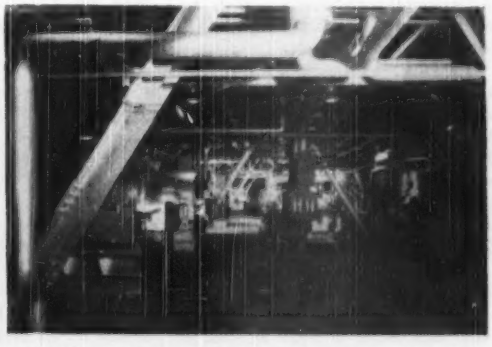
of station power in a two-floor bay and the short bus from generator to transformer are clearly evident

control steam temperature. Throttle steam conditions are 850 psi, 900 F.

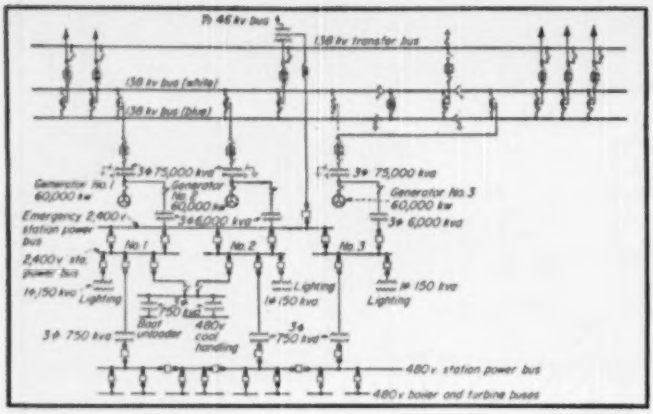
Fans, both forced and induced draft, are located above the steam generators, resulting in minimum expenditures for breechings and air ducts. Higher inlet air temperature to the forced draft fan is also obtained through recovery of radiated and other plant heat losses.

During the winter months combustion air enters the building through





CLEAR AISLES and ample working areas are provided on a forced and induced draft fan deck that is located above the steam generator to give decreased expenditures for breechings and air ducts (left). Careful arrangement of auxiliaries in basement pump area is evident



ELECTRICAL CONNECTIONS of 14.4 kv from 60,000-kw units show breakers omitted

louvered openings and over heating coils supplied with steam bled from the turbines, entering the forced draft fans at 100 F or above. In warm weather the air can be obtained through windows at the operating floor or other levels.

No Boiler Water Treatment

Following the usual practice in our design, no chemical treatment is added to the boiler water and complete deaeration is accomplished with provisions in the hot wells of the condensers. Two high pressure and two low pressure closed heaters and a drain cooler are used in the feedwater and condensate cycle for each of the turbines.

The evaporator supply is treated in a lime-soda ash softener and is deaerated in a contact type open heater by steam vented from the first high pressure heater, which also serves as the evaporator condenser. This insures elimination of oxygen and CO_2 from the make-up supply.

A high level surge tank which regulates the quantity of water in the system is connected to the boiler feed pump suction header. High water in the surge tank opens a float controlled valve, permitting excess water to flow into the clear well. Low water opens another valve, permitting the vacuum in the condenser to pull water from the clear well into the system.

Ample circulating water is available and water delivery of coal is provided at the plant site on Muskegon River and Lake, near Muskegon, Michigan. This lake is navigable from Lake Michigan and assures excellent docking facilities.

Belt conveyors handle coal from the freighters to the plant and to and from yard storage, and the coal supply can be mixed to any desired proportions by varying speeds of the feeders on the traveling tripper and reclaiming crane. Facilities are adequate to fill the bunkers in one 8-hr shift for a full day of operation of the ultimate plant.

The coal pulverizing system consists of three bowl mill pulverizers per boiler, with direct-connected exhausters driven by constant speed motors. Feeders are driven through a speed changer and clutch feeder drive. Coal flows from the hoppers in a specially designed chute and all of the piping from the feeders to the pulverizers is straight to reduce possibility of stoppage due to packing of moist coal.

Bunkers Under Suction

Considerable attention was given to plant cleanliness. The coal bunkers are kept under slight suction while being filled, and all transition points in the coal handling system are sealed and also subjected to a slight suction.

Discharges from the hoppers under the dust collectors, economizers and air heaters are connected to centrifugal hydraulic dust valves. The fly-ash laden water is run to a slurry tank located in the basement, from which it is pumped to an ash disposal field. The furnace ash removal system sluices the ash by means of jets from the boiler ash hoppers into a pit, for pumping to the ash area.

Generator Breakers Omitted

Bus connections from the generator terminals direct to the outdoor substation represent a major saving compared to the usual large breaker and cable installation. Use of pneumatic operated breakers for the high voltage connections gives high speed closing for synchronizing.

Copper buses for the 14.4-kv. connections are mounted on outdoor type porcelain insulators, supported on a steel frame with insulating barriers between phases. Ventilation is provided by use of expanded steel screen for the top and bottom enclosure. The buses are carried from the building through wall bushings to manually gang-operated disconnecting switches and an open bus is used from each switch to the three phase, step-up transformer terminals.

Transformers for station power supply are also direct-connected to the 14.4-kv connections thus saving the cost of high voltage, high interrupting capacity breakers. Each generator unit supplies its own station power from an associated 2,400-v station power bus. Excitation is of the conventional type, using direct-connected main and pilot exciters with quick response rheostatic voltage regulators.

Sensitive protection is provided for both the generator and the transformer by using two sets of percentage differential relays. One set includes the generator only and the other includes the generator and the transformer. Either set trips the high voltage breaker and the breaker on the low voltage side of the station power transformer.

Control Auxiliary Supply

Lengths of conduit and cable for supply to the plant auxiliaries are held to a minimum by location of the power bus and control equipment in a two-floor electrical bay which runs the full length of the plant between the boiler and turbine rooms. Transformers for the 480-v supply to motors under 100 hp and for lighting service are mounted on the roof adjacent to the electrical bay.

An auxiliary source of 2,400-v station power is provided to a transfer

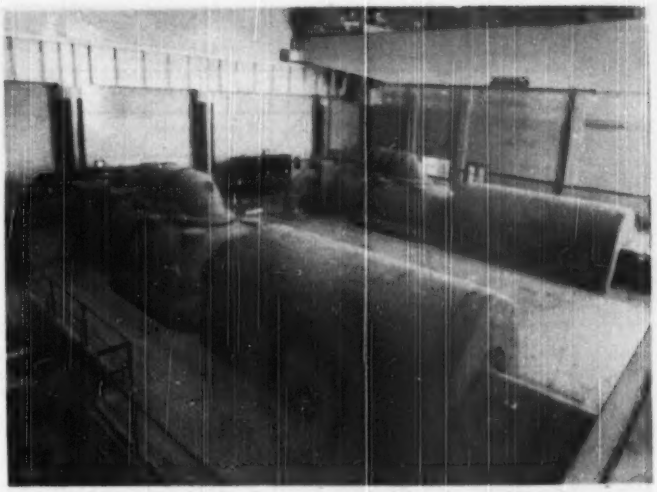
bus by the tertiary winding in a three-winding transformer which supplies the 46-kv bus from the 138-kv bus. With these connections, a generator can be started from the station power transformer of any unit which is in operation or, under emergency conditions, by using the transmission line source for system power supply.

To avoid repeated mechanical shock to motors, incident to open circuit transition, the two sources of station power are paralleled momentarily. The transfer is made as soon as the generator is brought up to speed and synchronized. The resulting circulating current through the station power transformer, due to slight differences in voltage and phase angle, is not sufficient to cause any difficulty.

Arrangement of control conduits from the outdoor substation into the plant control room is simplified by projecting the control room outside the main building walls. All control and relay equipment for the generators, station power main circuits and transmission lines are enclosed in this room. Space in the floor below this level is utilized for terminal compartments, auxiliary relay panels and station battery charging equipment.

Ample Building Space

Particular attention was given to the arrangement of equipment to assure safety, accessibility and ease of operation and maintenance. Clear aisles and ample working areas are provided throughout the plant. This is aided by incorporation of wind bracing in the steel frame of the building as well as by location of the auxiliaries for direct connections.



FIRST THIRD of Cobbs ultimate capacity of 360,000 kw is represented in two 60,000-kw units now in operation. A third will be added this year

Advantages of the plant location, considered with the problems of transmission and transportation involved in other possible sites, amply justified the relatively expensive foundations which were necessary. Bed rock lies approximately 200 ft below the ground level, with very unstable soil above, which necessitated the use of concrete filled 24-in. diam pipe piles.

To prevent delay in the construction schedule, the concrete base slab of the building was poured in two layers. A reinforced section 4 ft 9 in. thick carries the building load, and a 2 ft 6 in. section which was poured later provides space for the electrical conduits normally imbedded in the base slab.

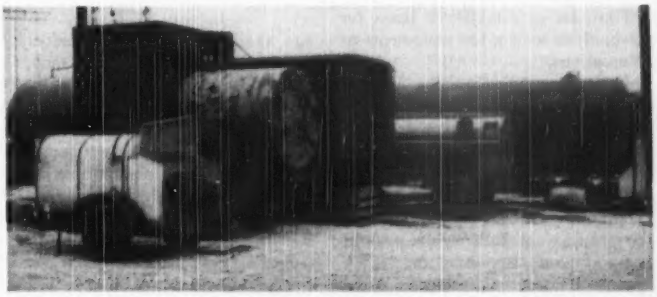
Exterior walls of the building are finished in a red texture, hard-burnt face brick and interior finish is ceramic tile. The roof trusses of the boiler room support a gunite lined welded steel plate stack for each steam generator.

Information for this article was supplied by J. H. Foote, G. C. Daniels, E. F. Dissmeyer, J. A. Elzi, L. T. Russell and C. D. Birget, and was assembled by F. E. Sanford, all of Commonwealth Services Inc.

• • •

Portable Filter Presses Aid Oil Removal

THE TOLEDO EDISON CO has three portable filter presses, two of which have 700-gallon storage capacity and one with 2,000-gallon storage. They are mounted on trailers and permit the removal of oil from oil circuit breakers for overhaul and filtering of carbon and moisture from the oil. Can also be used for temporary storage of oil while repairing miscellaneous equipment. It is not necessary to have presses located at the substations and these portable units have been found to possess the attributes of both versatility and economy.



THREE portable filter presses like this one are used by Toledo Edison for on-the-job removal of oil from oil circuit breakers—instead of having presses located at the substations

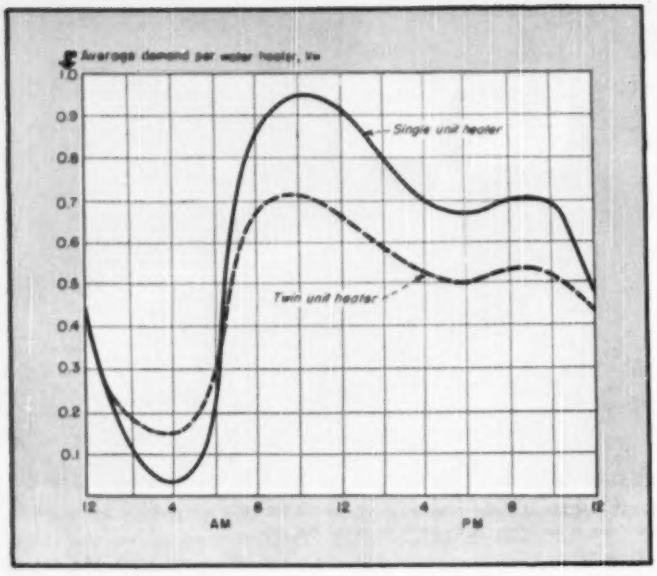


FIG 1—MAXIMUM DEMAND on water heaters controlled only by thermostats falls near 10 AM and major portion of load is on from 9 AM to 11:30 AM. Also, note evening load

Controlled Water Heating Costs Less To Serve

Application of a standard general power rate to water heater load indicates lower cost to serve when energy is supplied off peak

MILLARD C. WESTRATE
Asst Supt, Board of Public Works
Holland, Mich.

HOW can a utility determine the need for off-peak control of electric water heating?

First, let us establish a basis for the analysis with a few statements or assumptions.

1. Starting point and the ultimate requirement of any scheme is the hot water demand of the customer. Data available indicate that domestic hot water requirements are such that uncontrolled water heaters present a maximum demand that is highest in the morning and falls on the peak of many systems. Report of the NELA Water Heating Committee dated November, 1931, provides perhaps the most complete study of water usage available to date. Occasionally running out of hot water, such as when cleaning house, might be tolerated, but to run out weekly on washday is not satisfactory. Therefore any water heating scheme must be able to supply the normal maximum day, which is usually Monday, and if it does that then it will take care of every day.

2. Energy sold for electric water heating should be sold at a profit. Cost of serving may be calculated on an incremental basis when the water heating is made necessarily a part of the total residential load as is true with block rates. By incremental cost is meant the difference between investment required with and without water heater load. For generation this is usually considered the cost per kw for plant additions, whereas the distribution cost is only a percentage of the total cost because only the copper and transformers are usually affected by additions in load.

3. In many cases, electric water heating can be sold on features not offered by fuel burning units, but operating cost should approach that of other automatic methods of water heating in order to be really competitive. Any cost comparisons between electric water heating and other methods should not be based on the cost per Btu for fuel alone but on total costs including efficiency and maintenance. Initial investment is important but operating cost is of much greater concern.

4. Standard water heaters using 30 w per gallon for the upper element and 20 w per gallon for the lower element, with interlocking thermostats on two-unit heaters, and 50 w per gallon on single element heaters, have proved sufficiently satisfactory to justify limiting consideration to only standard heaters. In practically all cases the advantage offered by twin-unit heaters justifies limiting consideration to this type.

5. Any scheme must be satisfactory for practically all residential customers which is the only class being considered here. Special schemes to meet individual habits cannot be justified.

Determine Water Heater Demand

When water requirements have been determined, next step is to determine the amount of electric load to provide that amount of hot water. This divides itself into two phases: (1) Requirements with thermostatic control only; and (2) requirements with both thermostatic and time switch control. Figure 1 shows the average demand per heater for the maximum day showing both single and two-unit heaters with thermostatic control only.

How does this load fit into the system load curve? If the system load includes a fair balance between industrial and residential customers,

the maximum daily load curve probably looks something like Fig 2 and maximum system demand comes at a time when a very high percentage of the Monday washday water heater load is on. If the system has primarily a residential load the system curve would probably look like Fig 3, and a sizeable amount of water heater load will be on at the time of the evening peak.

In either case it shows that twin-unit water heaters average from 0.5 to 0.7 kw on peak demand if they are controlled only by their thermostats. This is the average diversified demand at the substation or power plant. It is somewhat higher on the distribution system, approaching the rating of the heater in the demand on an individual transformer.

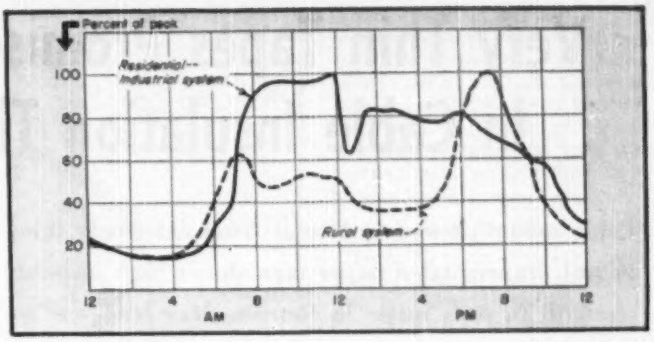


FIG 2—TYPICAL LOAD CURVES for rural system and system with residential and industrial load. Rural system peaks between 7 and 8 PM when 75% of uncontrolled water heater load is on. Residential-industrial system also has a peak between 7 and 8 PM

On-Peak Demand Costs

What do these "on peak" demands cost? Let us look at what customers are charged on loads where demands are measured. The rate schedule of one large utility company includes a demand charge of $4/kw for the first kw and $3/kw for the next 9 kw of billing demand with steps of $2.20 and $1.80 for higher demands. Since the first step is probably designed to cover billing costs, the second step of $3/kw is believed to be more indicative of what an "on peak" kw is worth. This rate seems particularly appropriate for a study of this kind, because, the energy charge is 1.2¢ for the first 2,000-kwhr block and there are steps of 1¢, 0.8¢ and 0.7¢ for blocks of 200 kwhr/kw of demand with a coal clause addition. Using a water heater demand of 0.7 kw and a monthly use of 300 kwhr the load factor is comparable to about half-way between the 1¢ and 0.8¢ steps on this power rate. This means that, after charging $3/kw demand for power, this company also charges about 0.9¢/kwhr for the energy used or about the same as most utilities charge for controlled water heating without the demand charge.

Another approach to this problem of "on peak" demand costs is on the basis of system investment. The cost per kw of plant capacity at today's prices is probably about $200 on which fixed charges are about 10% or $20 per year. This should probably be increased by from 10% to 50% to allow for the ratio of total capacity to firm capacity. A good average would be $25 per year per kw. Distribution investment will be perhaps $100/kw but this would not necessarily increase directly with load. Assuming that half of the distribution costs are for copper and transformers the fixed charge amounts to $5 per year per kw.

Hence, combined fixed charges for the generating plant and the distribution system amount to $30 per year or $2.50 per month which roughly checks the $3/kw found in this company's rate.

On the basis of the analysis, so far, we have a load with about 0.7-kw demand and a monthly use of about 300 kwhr. To serve this load requires equipment carrying a fixed charge of $2.50 per month/kw. Assuming an operating cost of 0.9¢/kwhr at the generator to cover fuel, labor and maintenance, the charge for water heating should be at least 1.5¢/kwhr to cover fixed charges, distribution costs and other overhead.

With Off-Peak Control

As an alternate, consider reducing or eliminating the demand charge by means of off-peak control. Whether time clock or carrier control is considered makes little difference, because provisions must be made to take care of the maximum day. The scheme chosen should allow for anticipated percentages of saturation. If more than 10% saturation is considered it will be found that on many systems there is not room for all heaters to be on at any time during the day without creating a peak. In fact there are surprisingly few kilowatthours that can be considered off peak during the day.

For general consideration of time controls it is only necessary to consider the type with the minimum cost consistent with reliability. While there is no control that does not give some trouble, time clocks have been used enough to show that they are reasonably satisfactory. Today the added cost for a combination single-pole time switch in a meter is about $15. This can probably be reduced if production is increased by a more universal usage.

Now if we consider the fixed charges on this $15 additional cost for a time switch at 10% and allow $1 per year maintenance we have only $2.50 per year for the control, and if operating costs are less than 0.9¢/kwhr we can still sell energy for water heating at 1¢ and show a little profit.

Actually it is difficult to evaluate the operating cost of off-peak energy. The improvement in load factor should make for more efficient operating conditions and therefore the off-peak energy should actually cost less than the average.

This analysis can be made to fit almost any system by adjusting the figures for costs and peaks. To sum it up, using data and analysis presented here, off-peak water heating can be sold at 1¢/kwhr while a charge of 1.5¢/kwhr minimum would be required for domestic water heating which operates only with thermostatic controls.

Very Thin Tapes Promise Reduction In Cable Insulation Thicknesses

Cable manufactured in France from extremely thin, ½ mil, impregnated paper tape shows high impulse strength in tests made in Detroit. May lead way to new developments in cable design and manufacture

L. DOMENACH, Technical Director, Les Cables De Lyon, Lyon, France, and
L. I. KOMIVES, Division Supervisor-Cable, The Detroit Edison Company, Detroit

INVESTIGATIONS in this country and abroad during the last 15 to 20 years have thrown much-needed light on the problem of impulse strength of underground cables. The understanding of this problem gained added importance in the design of cables for extra high voltages which became necessary to take care of tremendously increased loads. The insulation thicknesses of such extra high-voltage cables have been found to be determined mainly by their impulse strength.

It has been widely recognized that the impulse strength of a given insulation thickness of higher voltage paper insulated cables will depend upon the density and thickness of the paper tape, provided other factors are equal.

Tests conducted in Detroit and elsewhere, in 1941 and earlier, convinced engineers of The Detroit Edison Co that the application of higher than normal density paper tapes in the vicinity of the conductor in the high stress region, results in an appreciable increase in impulse strength of the cable. Other tests, such as short and long time voltage and load cycle tests, however, indicated that the employment of denser paper tapes in the high stress region has an adverse effect on the life of the cable under lower than surge voltage conditions. (1). This apparent contradiction strongly suggested the need of careful design and compromise to obtain an all-around satisfactory cable as well as a second look in the direction of using thinner tapes.

Extremely Thin Tapes

Les Cables de Lyon of Lyon, France, one of the manufacturers who produced the 220-kv Paris underground cable which has been in service without trouble since 1936, is experimenting with the application of extremely thin tapes for two reasons: (a) To be able to produce a cable which will operate successfully at 400 kv ac and (b) to improve the dielectric strength for all high voltage cables, thereby enabling the cable industry to reduce insulation thicknesses. The Swedish Government placed an order for three lengths of 400-kv single-conductor cable with Les Cables de Lyon some time ago, and from rigorous tests and sifting all available data, it seems that the application of 200-psi oil pressure and the use of very thin tapes, at least in the high stress region, is very desirable for the success of such a cable.

Highest-Voltage Cable

This cable, which will be the highest voltage cable in the world, could not be made with normal tapes to obtain the same safety factor without making the insulation too bulky and impractical to manufacture. Even with the extremely thin tapes in the high stress region, which permit a maximum operating stress of nearly 400 v per mil or approximately 50% higher than in the highest voltage cable in this country, the insulation thickness is about one inch and the outside diameter nearly four inches—both near the limits of practical manufacturing.

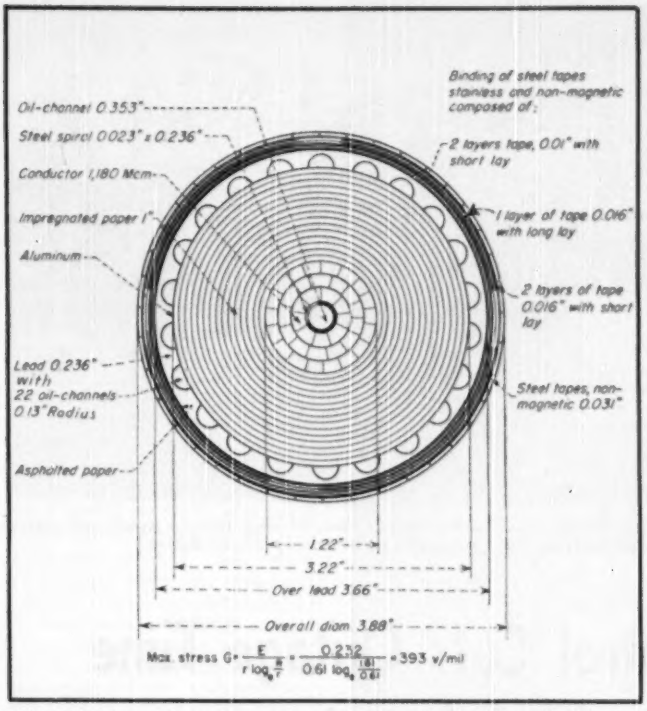
To gain experience with the use of such thin tapes for solid-type cable, Les Cables de Lyon manufactured three lengths of 60-kv cable with a reduced insulation thickness of 360 mils instead of the present standard of 600 mils. These lengths, 790 ft—complete with joints and terminals, are at present being tested by the Electricite de France in Paris at a potential 150% of normal 90 kv, instead of 60 between phases, and with load cycles to raise conductor temperature to 50 C.

An opportunity was presented to exchange knowledge and obtain information on the influence of extremely thin tapes on the surge strength of the cable when Les Cables de Lyon agreed to supply samples

RESEARCH IS NEEDED

Samples of 60-kv solid-type cable employing extremely thin (½ mil) impregnated paper tapes, manufactured by Les Cables de Lyon of Lyon, France, were impulse tested in Detroit. The tests indicated substantially higher impulse breakdown strength than shown by other similar cables, using thicker tapes throughout the insulation. It is felt that if ac tests on this cable now in progress in Paris, France, show similar results, the use of thinner than conventional tapes in extra high voltage cables should be considered and encouraged. A research program along these lines should be of help in the reduction of insulation thicknesses of cable types now in use, and would prepare the way for cables to be operated at voltages of 230- to 380-kv in this country.

The Authors


Binding of steel tapes stainless and non-magnetic composed of:
Oil-channel 0.353"
Steel spiral 0.023" x 0.236"
Conductor 1,180 Mcm
Impregnated paper 1"
Aluminum
Lead 0.236" with 22 oil-channels 0.13" Radius
Asphalted paper
2 layers tape, 0.01" with short lay
1 layer of tape 0.016" with long lay
2 layers of tape 0.016" with short lay
Steel tapes, non-magnetic 0.031"
1.22"
3.22"
Over lead 3.66"
Overall diam 3.88"
Max. stress G = E / (r log_e R/r) = 0.232 / (0.61 log_e 181/0.61) = 393 v/mil

THIN TAPES have made possible manufacture of 400-kv 1/C, 1,180 Mcm cable having insulation thickness of 1-in. and 4-in. over-all diameter. Cable is for Harspranget (Sweden) line

Impulse Breakdown Test Results

Sample No.	No. of Impulses	Type of Wave	Peak Kv	Avg. Gradient V/Mil	Max. Gradient V/Mil	Failure
I.....	22	1-1/2 x 40	330 to 702	....	....	.....
	10	1 x 50	795	....	....	.....
	1	3/4 x ?	885	2460	3600	3 in. under lead
II.....	2	1-1/2 x 40	370	....	....	.....
	2	1-1/2 x 40	620	....	....	.....
	1	3/4 x ?	895	2470	3650	2-3/8 in. in stress cone

and The Detroit Edison Company to test these samples with their impulse generator in Detroit according to the schedule mutually agreed on.

Tests Show High Surge Strength

The cable tested consisted of a 474 Mcm swaged (smooth surface) copper conductor and 360 mils of impregnated paper tape insulation of the following construction:

No. of Layers	Approximate Thickness of Tapes Mils	Width of Tapes In.
41	3	0.78
65	2	0.56
43	1.5	0.56
135	0.5	0.31

Shielding, lead sheath and a protective layer of compounded jute completed the cable.

Results of the impulse breakdown tests are summarized in the table immediately above.

Negative potentials were used throughout the tests. Furthermore, the limitations of the impulse generator necessitated the use of steeper than standard wavefronts at high potentials.

The impulse breakdown test results obtained in Detroit compared favorably with the 820 kv (1/50 negative wave) registered in Lyon. Failure in both Detroit samples occurred in the vicinity of the base of the terminal test cone, and may not represent the full strength of the undisturbed cable. In all specimens examined in Detroit, severe buckling of the tapes was observed on the side of the cable containing the faults, this buckling having occurred throughout the length of the cable.

Surge Strengths

From the point of view of surge strength alone, data obtained in Detroit is extremely important. The surge strength of this cable with extremely thin tapes, made by Les Cables de Lyon, exceeds by far the surge strength of any cable on which reliable and directly comparable data are available. Basing comparisons on maximum gradients, the nearest directly comparable figures are those of Held and Leichsenring (3), Komives (2) and Faucett (1). The Foust and Schott (4) tests reported by Komives (2), were made on standard oil-filled cables and because of the effect of stranding are not directly comparable to cables with smooth conductors. Many cable engineers feel that average rather than maximum stresses at breakdown should be the criterion for comparison. The Cables des Lyon cable stands out in the field as only two samples reported by Held and Leichsenring (3) that are anywhere near to it.

The Detroit tests seem to indicate that to obtain higher impulse breakdown strength in underground cables, types with insulation thinner than the conventional 5 mils should be used, at least in the high-stress region of the insulation.

The long-time, over-voltage and load-cycle tests now in progress in Paris will, it is hoped, give assurances that no essential characteristic was sacrificed to obtain such high impulse breakdown strength.

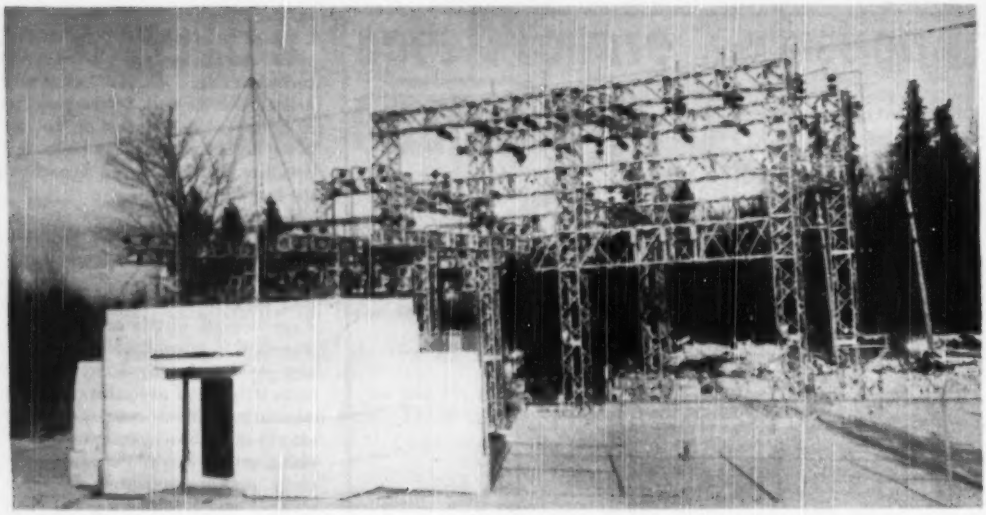
Bibliography

1. 120 kv High-Pressure Gas-Filled Cable—Faucett, Komives, Collins, Atkinson—*AIEE—Transactions*, Sept. 1942.

2. Impulse Strength As A Measure of Cable Quality—L. I. Komives—*Electrical Engineering*, Oct. 1941.

3. The Impulse Strength of High Tension Cable Installations—C. Held and H. W. Leichsenring—*CIGRE* Paris, 1939.

4. Some Impulse Voltage Breakdown Tests on Oil-treated Paper-insulated Cables—C. M. Foust and J. A. Scott—*AIEE—Transactions*—July, 1940.



ANTENNA atop the building in front of the rural substation serves an FM transmitter and receiver in the 152-162-megacycle range. The system transmits alarms for voltage failure or feeder breaker lockout, and provides remote reclosing of feeder breakers

Radio Control Cuts Outage Time At Rural Substations

Automatic alarms for feeder breaker lockout or loss of voltage, plus remote reclosing assist in dispatching proper crews, speed clearances, cut outage time

NORMAN S. KENT
Communication, Protection and Testing Supervisor
B. C. Electric Co, Vancouver, B. C.

RADIO CONTROL of rural substations, used in conjunction with a separate two-way mobile radio telephone communication system by BC Electric Co, has improved service from the stations. Very high frequency radio control to indicate power failure or feeder circuit breaker lockout and to reclose feeder circuit breakers remotely has been applied to two rural substations in the Fraser Valley, and four more installations are underway or planned.

Improved service through substantial reduction in outage time has been realized as a direct benefit of the installations. Instead of waiting to be notified by disgruntled customers, the load dispatcher knows immediately of loss of voltage or feeder breaker lockout at the station. If the feeder outage is due to a momentary fault, service is restored without delay by automatic three-operational reclosing feeder breakers. If it is a sustained fault, a feeder breaker lockout alarm results and a mobile radio line truck is dispatched to the scene of the trouble. Two maintenance groups, linemen and servicemen, are available and one or both can be radio-dispatched to the station, depending on the radio alarm and the surrounding system conditions.

The 12-kv feeders are sectionalized manually either inside or outside the station, depending on location of the faults, and the lineman receives his clearance by radio from the load dispatcher. When the fault is cleared the load dispatcher is notified on the spot by radio and dials the feeder breaker closed, restoring service immediately. The serviceman is required to reset the automatic feeder breaker reclosing relay at the substation at his convenience, but the circuit is back in operation in the meantime.

Stations controlled are outdoor distribution type with double feed. Two 34-kv lines (ultimately to be 60-kv) are available for feeding the stations which utilize motor-operated line disconnects for automatic line changeover. Each station has a single transformer capacity of 3,000 kva with two 12-kv feeders, and provision for ultimate capacity of 6,000 kva with four 12-kv feeders.

The radio control system as designed for this application serves three functions:

1. Automatic alarm to the load dispatcher on an ac voltage failure at the substation, and means for him to cancel the alarm.

2. Automatic alarm to the load dispatcher on a feeder breaker lockout and means for him to cancel the alarm.

3. Remote reclosing of feeder circuit breakers by the load dispatcher.

Relays and auxiliary equipment make possible the automatic features of functions 1 and 2. Radio dialing facilities at the dispatcher's office provide function 3 and the cancellation feature of functions 1 and 2. The feeder circuit breaker lockout alarm may be dialed off, leaving the breaker open but ready for reclosure when desired, or the breaker can be dialed closed, turning off the radio equipment and the tone alarm. Coded tones differentiate between the various substations, and high and low tone frequencies differentiate between the two alarm functions (loss of voltage or breaker lockout) at each substation.

Alarm Classifications

Alarm classifications and personnel dispatched therefor have been set up generally as follows:

1. Voltage alarm;

a. 34-kv remote switching with failure of the motor-operated line changeover disconnects—servicemen required

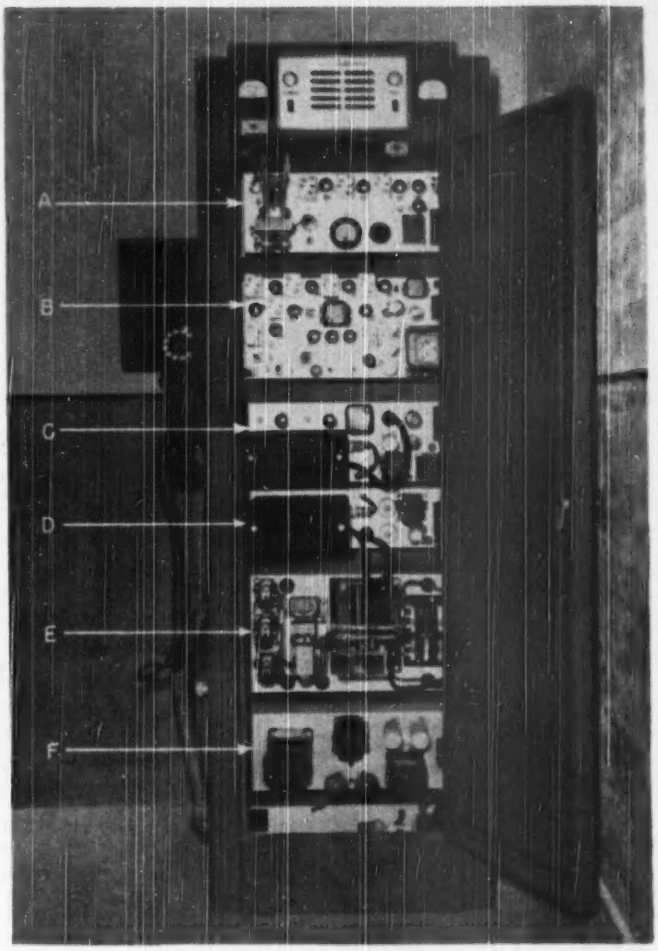
b. 34-kv line fault with failure of the motor-operated disconnects—linemen and servicemen required

c. 34-kv line fault only—linemen required

d. Local power failure caused by blowing of transformer high tension fuses either by a bus or transformer fault—servicemen required.

2. Feeder circuit breaker lockout alarm—linemen and servicemen required. Under this case only the linemen maintenance group is dispatched immediately, as already outlined.

Radio and associated control equipment in the substations consists of transmitter, receiver, tone oscillator and selector panels, control panel, transmitter power supply, transmitter control panel, and emergency power supply.



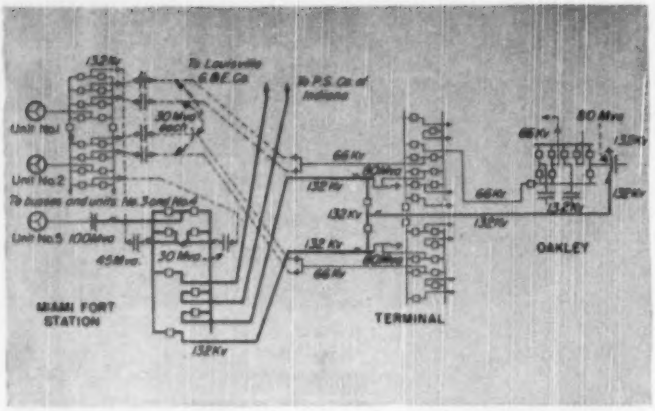
TONE OSCILLATOR and selector panels (C and D) which modulate the carrier to distinguish between alarms and stations, and to perform the proper operating function, are mounted with the transmitter (A), receiver (B), control panel (E), and power supply (F)

The 15-w frequency-modulated transmitter operates in the 152-162-megacycle range and is self-contained except for the filament and high voltage plate supplies for the seven tube types used. The FM receiver is a 14-tube, crystal-controlled, single frequency, double conversion superheterodyne, also with a range of 152-162 megacycles.

The tone oscillator and a selector unit are mounted on a panel with power supplies for both. The selector unit is essentially a ten contact rotary stepping switch, including a two-tube electronic circuit. It provides the decoding function of the radio dialing to enable cancellation of the tone alarm by a normal dialing operation at the dispatch office.

A second selector unit and power supply provide the decoding function of the radio dialling for reclosing any one or all of the feeder circuit breakers by a dialing operation at the dispatch office. Other units in the equipment cabinet are a transmitter power supply, a control panel for the transmitter, and relays and equipment to perform the automatic control functions required.

Emergency power is supplied by a motor-generator set which runs off a 24-v battery.



SIX STEPS taken to boost capacity; (1) Paralleling four 30-Mva transformers in pairs; (2) Conversion of two 66-kv circuits to 132 kv; (3) Conversion of one 66-kv terminal at Oakley to 132 kv; (4) Installation of 132-kv to 66-kv transformers at Terminal and Oakley; (5) 132-kv circuit to bus connections; (6) Increase interrupting capacity of 66-kv breakers

More Transmission Capacity At Lower Cost

J. W. HANSON
Senior Engineer
Cincinnati Gas & Electric Co
Cincinnati

WITH THE installation of 80,000 kw, 0.8 pf unit No. 5 at Miami Fort Station additional transmission capacity from that station to the load area in Cincinnati became necessary. Existing transmission was over two main channels: (1) Four 66-kv circuits to Terminal Substation and (2) two 66-kv circuits to Front Substation adjacent to West End Station. All these circuits were connected from the station 13.2-kv buses directly through transformers to lines with no 66-kv bus or switch structures. Transformer banks in the Terminal Substation circuits were each of 30 Mva capacity, and those in the Front Substation circuits were each of 60 Mva capacity.

Plans are to convert the Miami Fort to Terminal channel transmission capacity from the original 120 Mva to 360 Mva. Principal changes contemplated are:

1. Paralleling four original 30-Mva transformers in pairs, to each of two of the four 66-kv circuits, to produce two 66-kv circuits with a new capacity of 60 Mva each.

2. Conversion of the other two 66-kv circuits to operation at 132 kv.

3. Conversion of one 66-kv circuit from Terminal to Oakley Substation to 132-kv operation.

4. Installation of step down autotransformers to connect the 132-kv transmission circuits to the 66-kv load buses at Terminal and Oakley Substations.

5. Connection of the two 132-kv circuits to 132-kv buses at Miami Fort and Terminal.

6. Increase of interrupting capacity of the 66-kv oil circuit breakers at Terminal.

From the viewpoint of economy of switching facilities the connections at Terminal Substation, diagramed herewith, should be noted. Only two 132-kv circuit breakers are used for three 132-kv lines and two 132-kv/66-kv autotransformers.

Protective schemes employed are essentially those which would have been used with circuit breakers in each transformer circuit. For the lines directly connected to the transformer, current transformers in the circuit breaker and in the transformer 132-kv bushings are used. Transformer differential protection is obtained from the current transformers in the 132-kv bushings of the transformer and the 66-kv bushings of the circuit breakers in the low side transformer connection.

The 66-kv bus at this substation was originally all dual switching. Since that time six circuits have had one of their circuit breakers removed for use in other applications.

At Oakley Substation the 132-kv/66-kv autotransformer includes a 13.2-kv tertiary winding of 35,000-kva capacity so that this transformer also supplies reserve capacity to the 13.2-kv load buses. In this case the 66-kv switching is common to the 66-kv/132-kv and 66-kv to 13.2-kv transformation.

Multi-purpose Miami Project

Creation of the 132-kv bus at Miami Fort Station, to which the 132-kv lines are connected (Item 5 above), was a multi-purpose project.

First, was increase in capacity of 132-kv interconnections to Louisville Gas and Electric and Public Service Co of Indiana. Limitation on these connections was the two transformer banks, total capacity 75,000 kva, which formed their connection to the 13.2-kv bus at Miami Fort. Connection of these transformers and the interconnections directly to the 132 kv eliminated the 75,000-kva transformer capacity limitation on the 132-kv interconnections, and also provided a needed increase in transmission capacity from the 13.2-kv buses to the Cincinnati load area. The new generating unit with a maximum output of 115,000 kva is connected through transformers to the high voltage buses.

The 132-kv bus structure, as shown in Fig 1, has single switches for each circuit with the exception of the generator circuit. For normal operation the two bus sections will be connected through the generator breakers. Use of the double circuit breakers will allow bus faults to be cleared with a minimum of disturbance to system connections and will allow for circuit breaker maintenance without interruption to operation of the generator.

General practice on our systems is single switching except where conditions such as this give justification for dual switching.

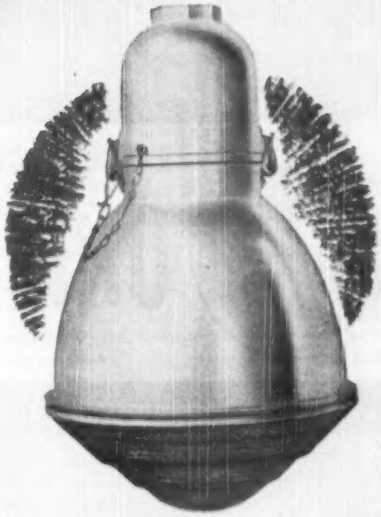
what's **New** in street lighting

4 WAY Optical Assembly for very long spacing in residential areas

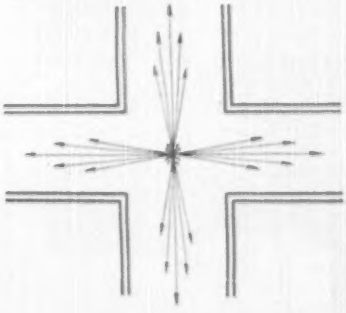
Here's a new high-efficiency luminaire, designed especially for right-angle intersections in residential areas. Companion to the already popular two-way Type VR, the new four-way Type VR directs light into four narrow, high-angle beams, 90 degrees apart.

This luminaire will find its greatest application on streets carrying very light traffic where the economy of long spacing, with 4000- and 6000-lumen lamps, is desirable. The Holophane Verti-lateral refractor provides a high angle of maximum candlepower—but with sharp cut-off above this angle. Because of the deeply shielded light source, the sharp cut-off, and the relatively low brightness of the apparent light source, glare is held to a remarkably low level. Minimum light is wasted on house fronts and off-street areas.

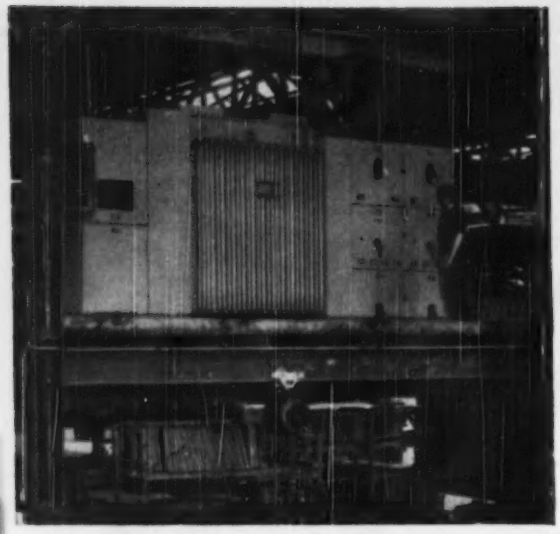
This new 4-way Type VR assembly can be used with G-E Form 79 or 101 aluminum hoods or with Form 45H and Form 72 wet-process porcelain insulators. Full information is available at all G-E Apparatus Sales Offices. *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

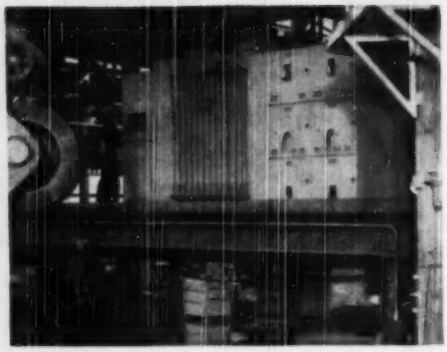


This is the 4-WAY Type VR optical assembly on a Form 79 hood. Using either 4000- or 6000-lumen lamps, the Type VR is economical both in installation and in operating costs. Maximum candlepower is emitted at a comparatively high angle, yet with excellent side shielding to give long, narrow light distribution on all four legs of a 90 deg. intersection.



GENERAL ELECTRIC





ALL UNIT SUBSTATIONS MOUNTED ON PLATFORMS TO SAVE FLOOR SPACE

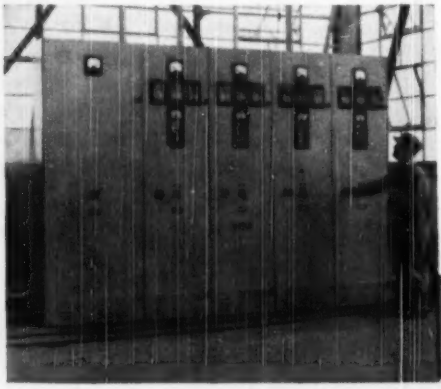
Two views of General Electric 1000-kva load-center unit substation at new Maytag plant. Valuable manufacturing space is saved by locating units on platforms under the roof, right over the center of the load area. Air switch on primary is easy to operate, contacts are easy to see. Air circuit breakers on secondary are of the drawout type, easily removable for inspection and maintenance. Note entire load center is metal enclosed, thus offering operating safety to personnel.

LOAD-CENTER

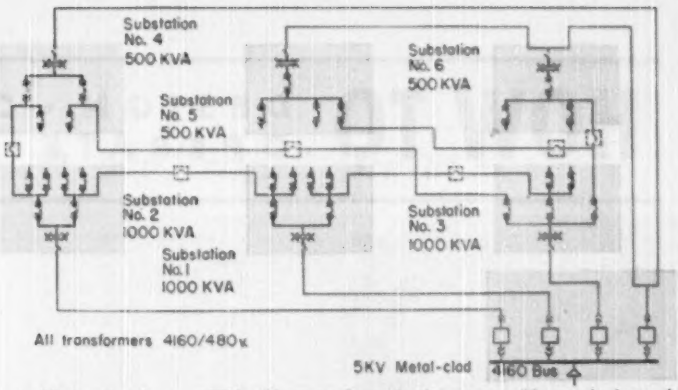
UNIT SUBSTATIONS

Unit substation No. 5, rated 500 kva. Air circuit breaker for future circuit can be inserted in empty upper housing. Drawout breakers are G-E Type AK-1 with 25,000 ampere interrupting rating—plenty of "IC" (Interrupting Capacity) to handle all short circuits. Contacts of 5 kv air switch are clearly visible through window, another safety feature of G-E substations.

G-E 5-kv metal-clad switchgear handles 4160 volts incoming power, distributes it to six load-center unit substations where it is stepped down to 480 volts for utilization. Metal-clad switchgear is neat in appearance, saving in space, and offers safety to operating personnel. Additional sections can be added for future expansion with a minimum of bother and expense.



CONTINUOUS POWER ASSURED MAYTAG BY SECONDARY-SELECTIVE DISTRIBUTION SYSTEM


Substation No. 4 500 KVA
Substation No. 5 500 KVA
Substation No. 6 500 KVA
Substation No. 2 1000 KVA
Substation No. 1 1000 KVA
Substation No. 3 1000 KVA
All transformers 4160/480v.
5KV Metal-clad
4160 Bus

This secondary-selective system at the new Maytag installation uses General Electric metal-clad switchgear to handle the incoming 4160 volts through four magne-blast power circuit breakers. Feeders distribute the 4160-volt power to six G-E load-center unit susbstations throughout the building where the high-voltage is stepped down to 480 volts for utilization—right at the center of the load area. This eliminates long, costly secondary feeders. Air switches on the primary of all load centers are rated 5 kv. Key interlocks give operating safety to personnel by preventing breaking of the load current with the air switch, or paralleling transformers.

With this secondary-selective system Maytag is insured against a power shutdown in case of failure of any one transformer or its primary feeder cable. If trouble occurs the normally open tie breaker is closed, thus providing an alternate source of power that permits the plant to operate at slightly reduced capacity.

The Maytag installation is a complete General Electric project—one source of responsibility plus the very best in coordinated planning, engineering, manufacturing, and service facilities to give maximum savings and efficiency to the customer.

HELP SPEED PRODUCTION AT THE NEW *Maytag* PLANT AT NEWTON, IOWA

ONLY G-E LOAD CENTERS GIVE YOU THESE FEATURES . . . .

SELECTED STANDARD ratings have been introduced by General Electric to bring you load centers on 20 per cent shorter shipments. The most popular are—

Low voltage	480 △ or Y, 208Y/120 volts
High voltage	2.4, 4.16, 4.8, 12, 13.2, 13.8 kv, delta
Kva ratings	300, 500, 750, 1000, 1500, 2000

Certain other *selected standard* load centers are available. Contact your G-E sales representative for further information.

NEAT APPEARANCE . . Note the smooth, integrated appearance of these G-E unit substations . . . no more gawky, "old-type" stovepipe connections between transformer and switchgear.

SAVE TIME by eliminating weeks spent over drawing boards detailing individual items. G-E factory-assembled unit substations are quickly and easily installed with lower material and labor costs than required for "piece-meal," makeshift affairs. No last minute "alterations" with hacksaws and cold chisels to make them fit.

INVESTIGATE TODAY how General Electric unit substations can be used in your plant for efficient, flexible power distribution. Contact your G-E sales representative for further information, and write today for the helpful bulletins listed below. *Apparatus Department, General Electric Company, Schenectady 5, New York.*

GEA-3592 Load-center Unit Substations
GEA-3758 Load-center Power Distribution
GEA-3083 Metal-clad Switchgear
GEA-4057 Interlocked-armor Cable for Primary Circuits
GEA-4352 Flamenol Cable for Secondary Circuits

"For our new plant that manufactures Maytag automatic washers, we wanted the very best in power distribution systems. That's why we chose a secondary-selective system using General Electric load-center unit substations. We found that a system such as this would be more economical than any other type. Even though the initial cost was slightly higher than a simple radial system, the fact that we were assured of continuous power for our manufacturing facilities, even though a transformer or feeder cable should drop out, meant that we would save time and money in the long run. We also chose a load-center system because we can easily expand it to take care of any increase in our manufacturing facilities. We also bought 'standard' unit substations because we discovered they would do the job just as well as 'specials'—and at far less cost—and because we could get better delivery. After the units arrived they were installed on the platforms and were operating in a very short time. And dealing with one organization saved us time and money because we could get the engineering, equipment, and service all from one reliable source."

L. C. McAnly, Sr., Manager of Manufacturing,
The Maytag Co., Newton, Iowa

Be sure to see the "More Power to America" full-color sound slidefilm "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.

GENERAL ELECTRIC

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

EMERGENCY SUBSTATION used by Duke Power Co to assure continuity of customers' service and to save time in restoring service in emergencies. Made from a comparatively small outmoded bus, it is easy to maneuver and can get into most all transformer locations

Portable Substation Saves Time in Emergencies

P. D. HUFF
Engineering Dept
Duke Power Co
Winston-Salem, N. C.

MADE from a small outmoded bus, this portable substation has saved the Duke Power Co a great deal of time in restoring service in emergencies. It is a comparatively small bus and is easy to maneuver into most every transformer location without the difficulty experienced with the cumbersome, wooden wheel substation previously used. Any licensed truck driver or other personnel can drive it.

All electrical and conversion work was done by members of our line crews during inclement weather when they could not work outside, also by workers in our bus body rebuilding plant, many of whose suggestions were adopted in the final design.

The bus selected was a Model 23R Twin Coach. It was stripped of all interior furnishings and the floor was reinforced with steel so as to accommodate the heavy concentrated load of three 100-kva 2400—120/240-v distribution transformers.

One of our line crews placed the transformers, installed the primary and secondary buses, primary disconnects and primary and secondary service wires. Our bus body rebuilding plant made certain alterations in the vehicle such as placing one-quarter inch mesh screen over the windows, arranging the emergency door so that the primary disconnects could be operated from outside the bus and providing locking means.

This emergency substation was first used in connection with changing the power bank serving a hosiery mill in Kernersville, North Carolina. This was done without interrupting the service to the mill, and the old bank was taken off the line, replaced with larger transformers and placed back on the line, after which the portable unit was removed. This work was planned and carried out during normal operating hours.

In order to conserve installation time and provide for more efficient operation of this unit, a boom pole arrangement was made whereby the primary and secondary leads could be quickly and easily raised and lowered into position. The foreman of the bus body rebuilding plant used the parts of an old automobile steering gear, together with his own ingenuity, and constructed a winch arrangement for raising and lowering the boom. After this was fabricated and installed on top of the vehicle, the line foreman and his crew installed the primary and secondary service wires. No. 4, 5,000-v Neoprene cable was used for the primary service and two 4/0 Neoprene cables per phase were used for the secondary service. Neoprene cable was used for the primary bus inside the vehicle and the secondary bus structure consists of two ¼-in. x 3-in. copper bus bars per phase. The secondary and primary buses are so arranged to facilitate either wye or delta connections.

Since the majority of the urban and suburban distribution in this district is 4,160 v. 4 w the emergency unit is normally connected wye on the primary and wye on the secondary. In order to insure that the vehicle is in proper operating condition at all times, a service record is maintained. Necessary high voltage signs are provided on all sides of the vehicle.

In those cases where it is desired to use this station in connection with underground vaults, the primary is connected to the overhead primary line and rubber cable of sufficient size is used for the secondary. It is necessary to work out ways and means of getting the secondary from the portable station to the secondary bus in the vault. Also necessary protective precautions must be taken.

new I-50

"the best in watthour meters..."

It's a source of satisfaction to know that the meter we are selling is backed up with the best of engineering and manufacturing. We said that over a year ago, and now we have further proof. A look at the record shows excellent customer experience with more than 600,000 I-50's. This gives us added assurance that we are offering you the best in watthour meters.

With elimination of bearing maintenance, with sustained accuracy, unit construction, co-ordinated insulation, and other features, the I-50 makes possible great savings in testing and maintenance.

Truly the I-50 is the most modern watthour meter. As such, we feel it's the logical choice to replace old meters in your long-range retirement program—as well as the best for new installations.

Manager of Sales
METER AND
INSTRUMENT DIVISIONS

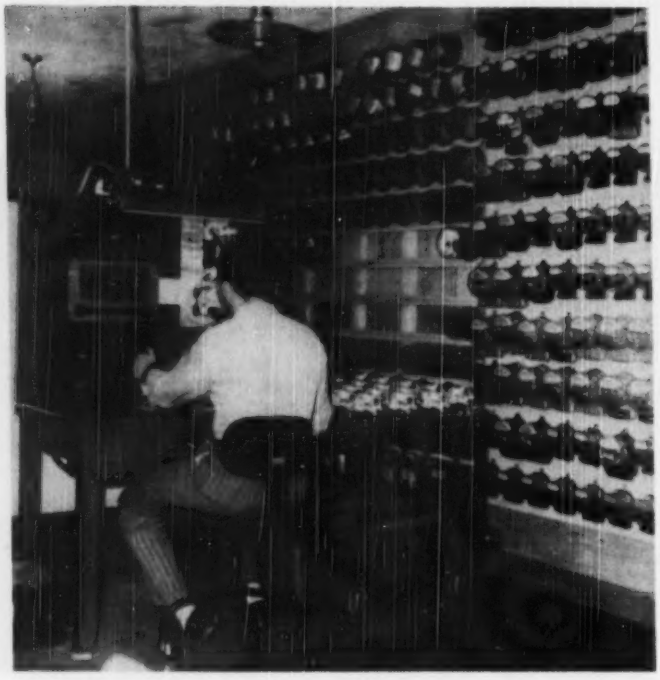
These Features Can Save You Money

1. **Co-ordinated insulation—for better performance under adverse conditions.**
2. **Magnetically suspended rotating element—to do away with bearing maintenance.**
3. **Braking magnets die-cast in frame—to assure calibration stability.**
4. **Current coil molded in butyl and potential coil in polyethylene—for greater insulation and stability.**
5. **One-piece molded "S" base—to minimize corrosion.**

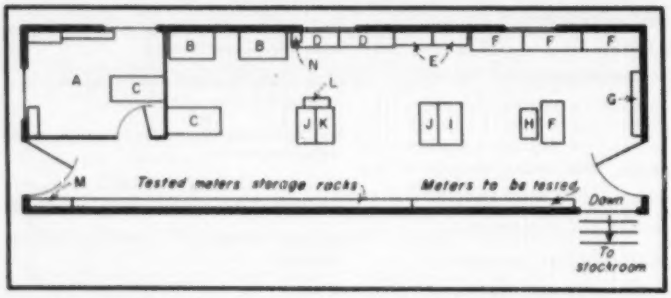
Type I-50, today's most modern meter

Order now from your nearest G-E representative. I-50 meters are available in socket- or bottom-connected types with pointer or cyclometer register. *Apparatus Department, General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC



ELECTRIC TEST PANEL for watthour meters, stock cart to save steps in reconditioning of meters, and section of meter storage racks. Panel has facilities for 1, 2, or 3-element meters



METER LABORATORY: A–office, B–meter record safe, C–desk, D–repair bench, E–repair parts cabinet, F–counter space, G–lockers, H–stock cart, I–instrument calibrating panel, J–watthour meter panel, K–demand meter panel, L–high-potential test, M–meter socket bins, N–register ratio checker. Shop was designed for space utilization and elimination of extra steps

A Compact Meter Testing Laboratory

R. L. DU COTY
Meter Supervisor
The Ohio Public Service Co
Elyria, Ohio

NEW meter laboratory for the Elyria Division of the Ohio Public Service Co has been designed and arranged along the lines of a modern efficiency kitchen. Compactly laid out, in a room that is 50 ft long and 14 ft wide, facilities are provided for a complete meter section including test and repair equipment, storage racks, record storage safes, repair parts stock, and instrument calibration and storage. Inside wall is utilized completely for storage racks which will accommodate approximately 800 meters of all types. Placed along the outside wall are repair benches, parts cabinets and record safes.

Test equipment consists of two watthour meter test tables, a group test table for thermal demand meters, utility test table for instrument work, Max-i-meter test and miscellaneous functions, and high-potential test cabinet. The tables are placed in two island groups in the center of the room with 4- to 6-ft aisleways on all sides. Both watthour meter test tables utilize the photoelectric revolution counter and are the single position type. One of the test tables provides facilities for testing one, two or three element meters, and switching is provided for series or individual element testing with a minimum of operations.

The high-potential test cabinet is equipped with safety interlocks on the door and removable back panel so the circuit cannot be energized with cabinet open. A 20:1 potential transformer and two half-wave rectifiers provide a test voltage of approximately 1,700 v dc. Switching through relays is provided to test between coils as well as from coils to frame. A panel voltmeter is flush-mounted on the front cover and leakage current is shown through its deflection.

General lighting of the room is provided by ten 500-w indirect incandescent fixtures. Each test table and repair bench is lighted individually by a fluorescent fixture.

A filtered forced-air unit is at one end of the room. It is thermostatically controlled for heating in winter and provides dust-free ventilation in warm weather. With doors and windows closed a slight air pressure is maintained in the room.

Policy of this meter department is to eliminate all field tests on residential meters, as well as small commercial and power meters on self-contained installations. Field testing is confined principally to transformer type installations and some indoor commercial and power meters; all others being scheduled for shop testing.

The meters are given "as found" tests, cleaned and repaired, calibrated and the necessary record entries made. The room is not crowded nor does it give the impression of overcrowding.

WE STOPPED THEIR BREATHING TO PROLONG THEIR LIFE!

On large tanks, Nitrile rubber gasket of circular cross-section is compressed as shown. Ring welded to tank keeps gasket in place—prevents too much compression.
On small tanks, Nitrile rubber gasket of square cross-section is compressed between rim of cover and deep-rolled flange on tank. Shown uncompressed.

In G-E Spirakore® transformers, Nitrile rubber gaskets—unharmed by oil, age, or operating temperatures—effectively seal out atmospheric air, moisture, and other contamination—thereby greatly prolonging the life of the insulating oil and consequently the units themselves. By redesigning the tanks, covers, handholes, and gaskets, we've made this sealing possible *and improved accessibility!*

Some years back, we sealed our power transformers completely. Now we've done it with all liquid-immersed, distribution transformers. We've stopped their breathing, too. We've made sealed tank construction available in all General Electric Spirakore transformers—from the smallest to the largest.

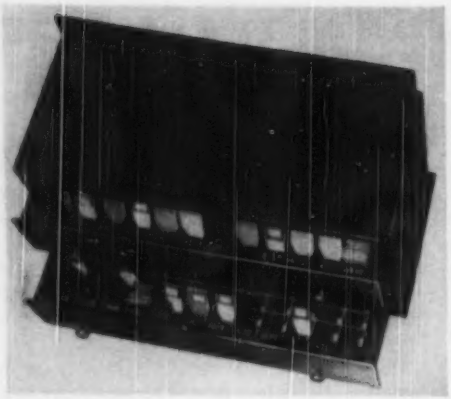
Other Improvements

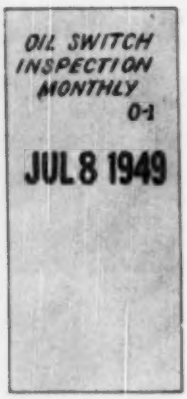
Yet sealed-tank construction is only one of the improvements you get with General Electric distribution transformers. You get Spirakore design—for great savings in size and weight. You get improved impulse strength. You even get a new and better baked synthetic-resin paint, which reduces maintenance costs.

Today—as ten years ago when lighter, smaller Spirakore transformers first made history—Spirakore still leads the field. It's the finest distribution transformer we have ever made, the finest you can buy. Ask for Bulletins GEA-4885 and GEA-4521. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

Spirakore Transformers

GENERAL ELECTRIC





MAINTENANCE CONTROL CABINET (left) has partitions in upper drawer for cards which assign and record work by days and weeks. Lower drawer carries similar cards for work to be done in assigned months. Inspection card (right) for oil circuit breaker has reference number (0.1) referring to detail of procedure listed in the instruction book. Date indicates when the inspection was performed. Color of card signifies workman assigned to job

"Ticket" Type Maintenance Schedule Cuts Out Writing

THOMAS BURGESS
Foreman
Electrical Maintenance Dept
New Bedford (Mass.) Gas & Edison Light Co

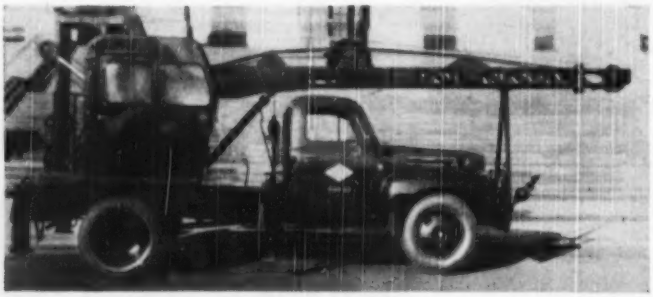
CLERICAL WORK practically has been eliminated in generating plant electrical inspections at New Bedford by the card and cabinet system shown. This method of scheduling and recording maintenance work has eliminated verbal assignments made daily by the foreman, the writing out of reports as jobs were completed and the description of maintenance activities following emergencies.

A file case with two drawers subdivided into compartments holds small cards identified with specific inspection jobs. Provision is made for allocating cards according to weekday, week-by-week and month-by-month work. Each man is assigned cards of one color. Cards indicate the apparatus to be inspected and a reference to an instruction folder or guide book for details.

For a weekly inspection, the workman removes his card from the front slot of the row marked "Monday" and performs the inspection. The card is then stamp-dated and returned to the rear of the "Monday" compartment. On Tuesday morning, cards in "Monday's" front section are moved to the middle slot to indicate that the work has not been done. Cards in the rear of "Monday's" section are returned to the front slot. Thus, the position of cards shows at a glance the progress of every phase of work.

Cards scheduled for bi-monthly to annual inspection are arranged in the lower drawer. These cards state inspection intervals as well as title and instruction folder references. After inspections, cards are stamp-dated and placed in proper row to insure inspection at the required time.

Hydraulic Crane Halves Transformer Replacement Time



MOBILITY and ease with which boom can be handled minimizes interference with traffic and makes this hydraulic crane ideal for handling transformers in congested city streets

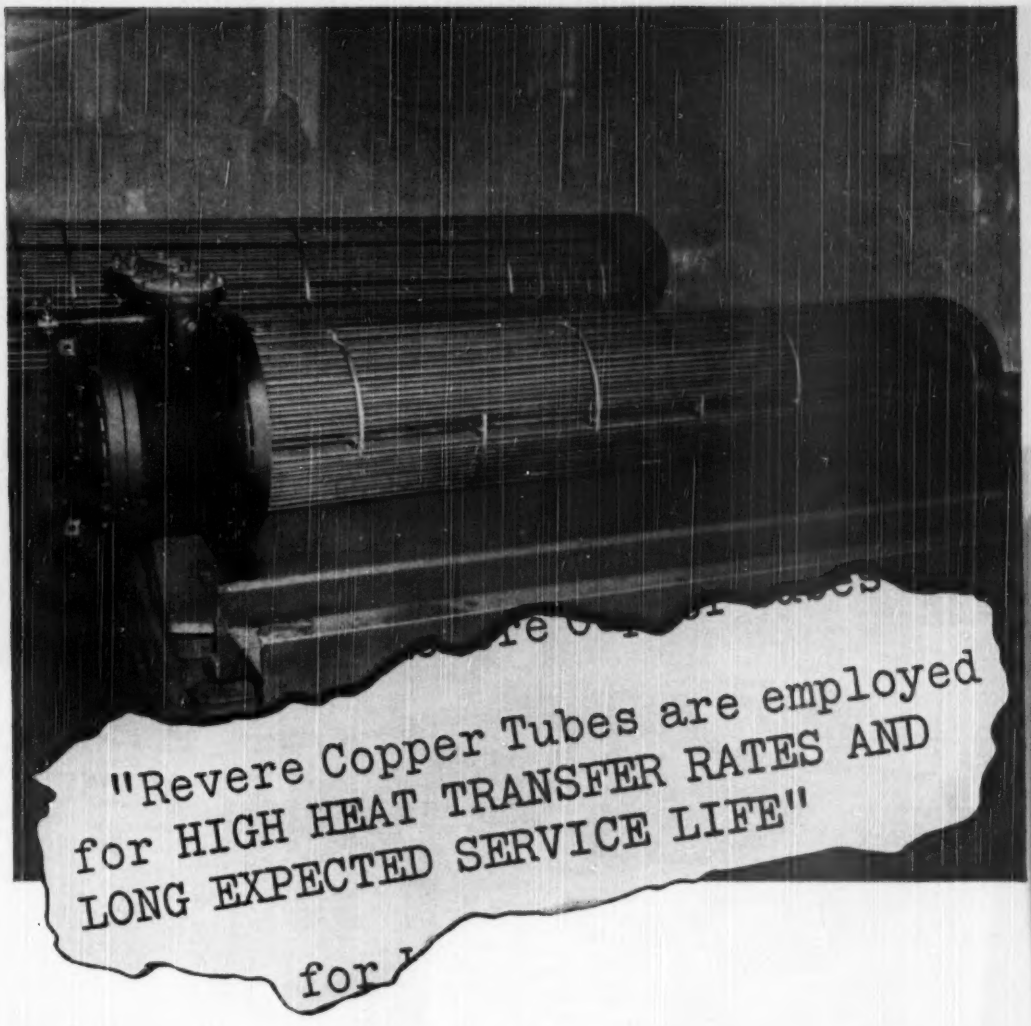
R. P. BROTZMAN
Assistant General Supt
Philadelphia Division
Transmission & Distribution
Philadelphia Electric Co

A LIGHT WEIGHT, 3-ton capacity hydraulic crane mounted on a 2-ton truck chassis has been found to cut, by more than 50%, the time required to install or replace transformers and other heavy equipment in manholes in highly congested city streets.

In addition to reducing installation costs, interference to pedestrian and motor traffic, street cars or buses is minimized by the mobility of the crane, outrigger, and boom.

The crane has been found to be ideal for placing regulators, reactors, etc, in substation basements where the head room on the first floor has been insufficient in the past to permit the use of ordinary cranes.

The crane controls, including a 26-ft telescopic boom and four outriggers, are all controlled hydraulically from the crane cab. The crane carries a ¾-yd bucket. For pipe laying or excavating work the truck can be moved by the operator by using a set of controls mounted on the crane platform in back of the truck cab. A 10-ft extension can be added to the boom.



The above quotation is from a letter by the Struthers Wells Corporation, Warren, Pa., accompanying the picture shown above. The picture shows two boiler feedwater heaters, intermediate and low-pressure, made by Struthers Wells for the generating station of a large public utility. These two tube bundles contain Revere deoxidized copper tubes, made to ASTM Specification B-111. One uses ¾" O.D. x #18BWG tube, while the other has tube ⅞" O.D. x #18 BWG. It will be noted that some of these tubes are bent to a small radius; superior bending quality is one of the features of Revere Copper Tube supplied for such purposes . . . In addition to copper tube, Revere offers for condenser and heat-exchanger service tubes in all the customary copper alloys, such as Admiralty Metal, Muntz Metal, the brasses and bronzes, and the cupro-nickels . . . For true economy it is important to select the correct size and alloy to meet actual conditions of use. Revere will gladly collaborate with you in such selection, whether for new equipment, or for re-tubing.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

• • •

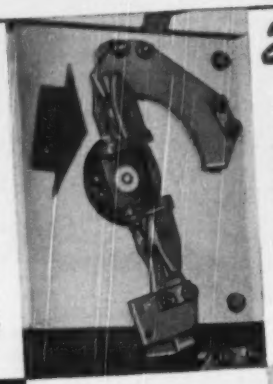
Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.
Sales Offices in Principal Cities, Distributors Everywhere.

MOLONEY *LOAD* TAP CHANGERS

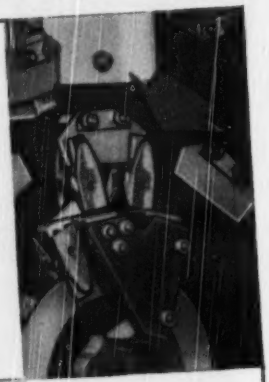
USED ON MOLONEY LOAD RATIO CONTROL TRANSFORMERS, REGULATING TRANSFORMERS, AND STEP VOLTAGE REGULATORS

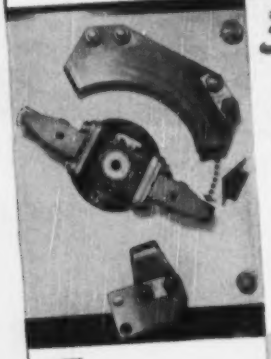
Better performance of Moloney voltage regulating apparatus is due in part to the advanced design of the Load Tap Changer switch assembly. Its many advantages are largely a result of the incorporation of a separate switch for performing all arcing duty, a feature heretofore provided only on large ratings of Load Ratio Control and Power Regulating Transformers.

1 Arcing duty is confined to but *four* moving contacts and *two* stationary contacts per phase, through use of a separate Load Transfer Switch. Current is actually interrupted on but one moving and one stationary contact per phase in changing from one operating position to another. Photo shows front half of switch.

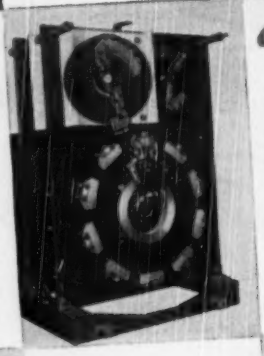


2 No arcing duty is imposed upon any of these Tap Selector Switch contacts, avoiding the necessity for replacement due to burning or scoring. Contacts are of hardened *copper alloy* to minimize frictional wear.





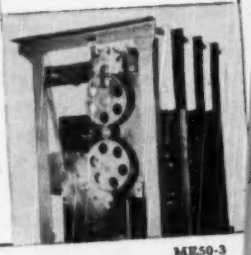
3 Greatly improved arc interrupting ability is provided through use of a separate Load Transfer Switch instead of the usual single switch arrangement which performs the dual function of breaking current and changing taps. The fewer contacts of the Load Transfer Switch make possible longer arc clearances.



4 Arcing is confined to a small area in contrast with the large area which is subjected to arcing on voltage regulating apparatus incorporating a single switch for breaking current as well as changing taps.

5 Insulating barriers in arcing area are faced with Melamine. This material is extremely resistant to the erosive action of arcs and arcing gases.

6 Wear cannot cause improper timing of the operations of the switches since not only are all parts solidly tied together by means of gears, but their timing is not critical.



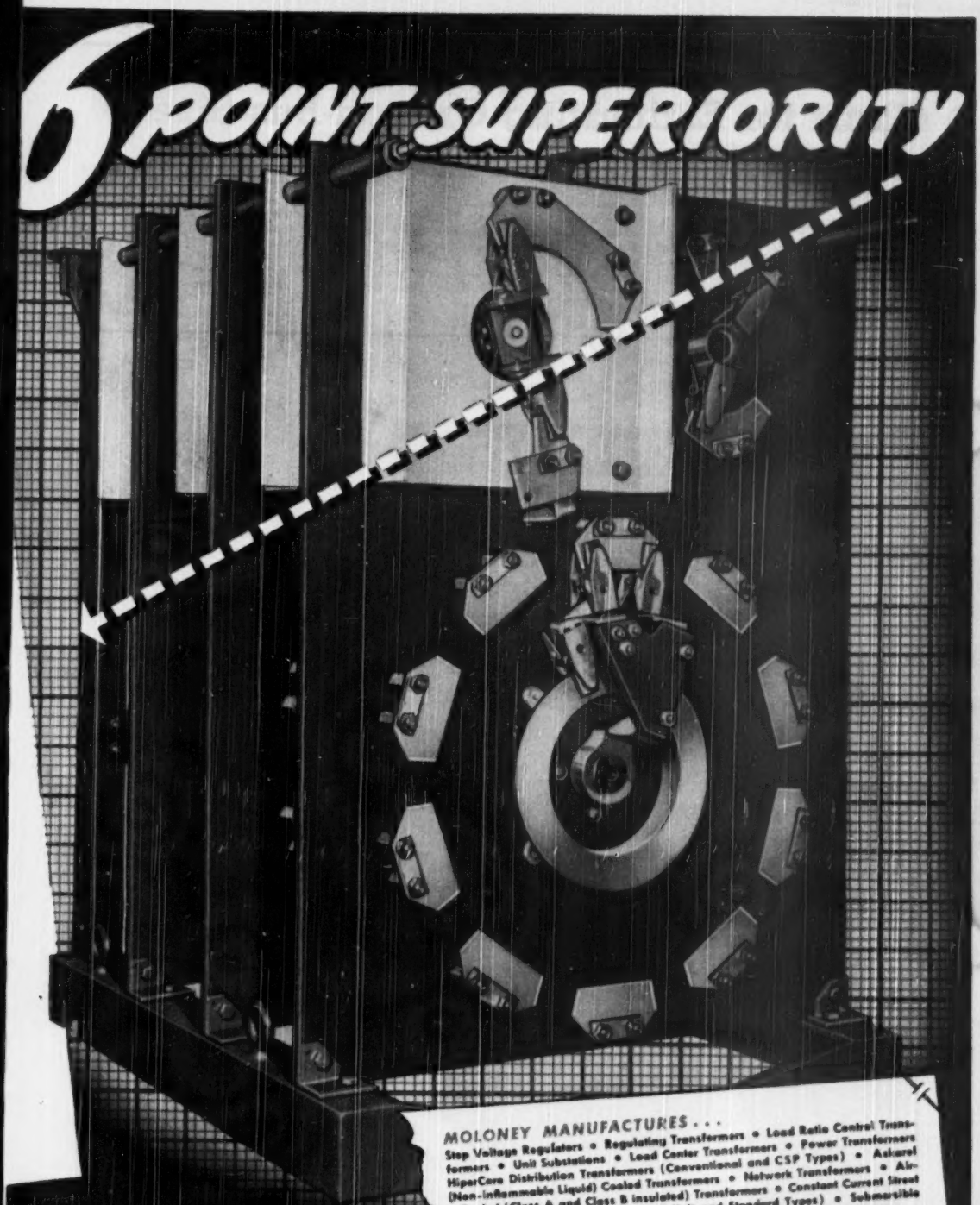
ME50-3

MOLONEY ELECTRIC CO.

Sales Offices in all Principal Cities

FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONTARIO, CANADA

6 POINT SUPERIORITY



MOLONEY MANUFACTURES . . .
Step Voltage Regulators • Regulating Transformers • Load Ratio Control Transformers • Unit Substations • Load Center Transformers • Power Transformers HiperCore Distribution Transformers (Conventional and CSP Types) • Askarel (Non-inflammable Liquid) Cooled Transformers • Network Transformers • Air-Cooled (Class A and Class B insulated) Transformers • Constant Current Street Lighting Transformers (Packaged Unit and Standard Types) • Submersible Type Transformers • Capacitors

Chart for Estimating Ground-Bus Size

Chart permits quick estimates of the cross-sectional area required for copper ground buses with bolted or brazed joints.

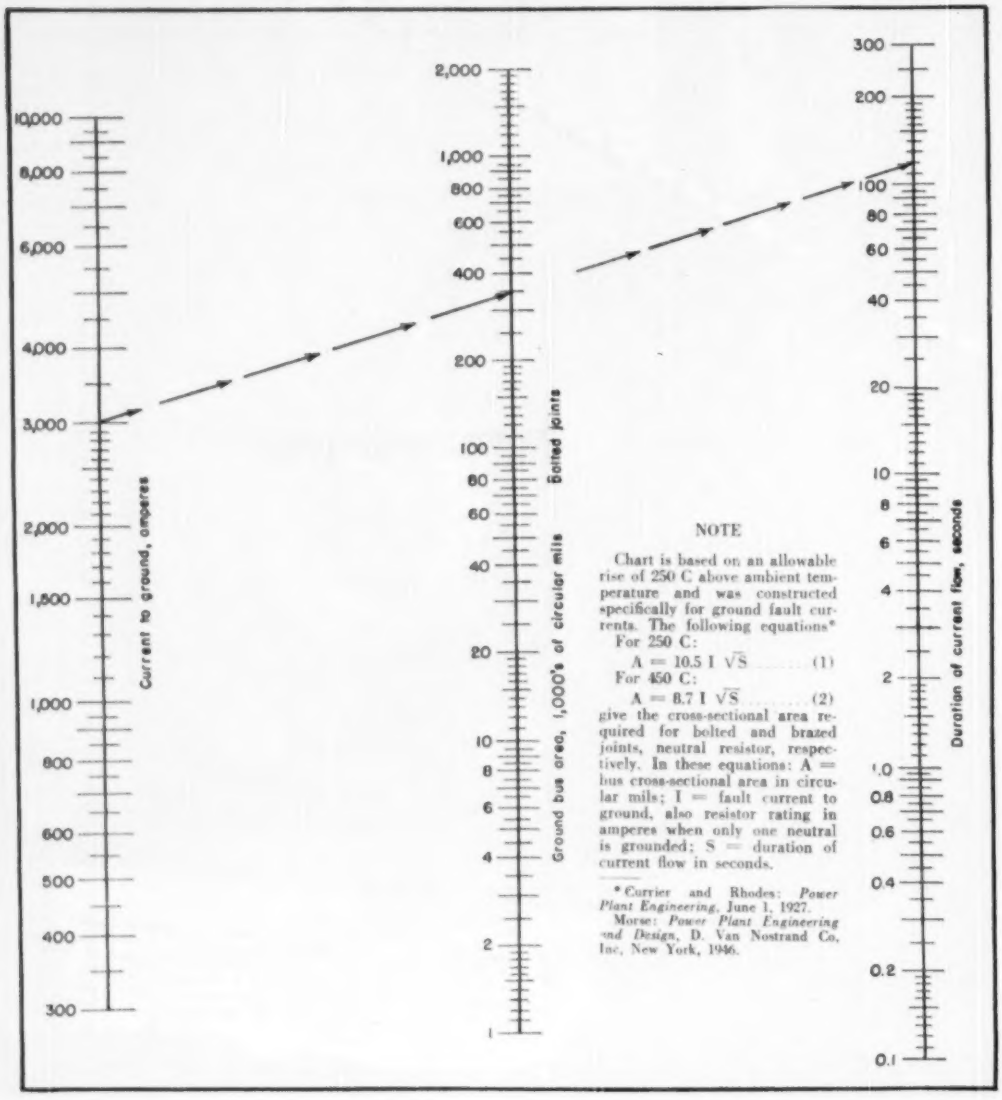
TYLER G. HICKS, Summit, N. Y.

Example for Use of Chart

PROBLEMS: A neutral resistor is rated at 3,000 amp for 2 min. What size ground bus should be used with bolted joints and what size with brazed joints?

SOLUTION: Enter the chart at 3,000 on the current scale and project to (2 x 60 =) 120 sec on the time scale. At the intersection with the area scale read 345 Mcm for bolted joints. Brazed joints, according to Eq 2, require (8.7 x 100/10.5 =) 83% as much area as bolted joints; hence, (0.83 x 345,000 =) 286 Mcm. Allowable rise = 450 C.

When the current rating of the resistor is beyond the range of the chart, divide the rating by some convenient number and solve as above. Then multiply the result by the number divided into the rating. For example, with a 16,000-amp rating, divide by 2 and solve by entering the chart at 8,000 amp. Then multiply the result by 2 to obtain the necessary area for a 16,000-amp flow.



NOTE

Chart is based on an allowable rise of 250 C above ambient temperature and was constructed specifically for ground fault currents. The following equations* For 250 C:

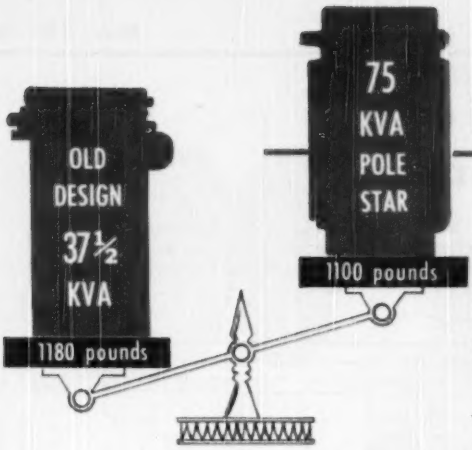
$$A = 10.5\ I\ \sqrt{S} \quad \ldots\ldots (1)$$

For 450 C:

$$A = 8.7\ I\ \sqrt{S} \quad \ldots\ldots (2)$$

give the cross-sectional area required for bolted and brazed joints, neutral resistor, respectively. In these equations: A = bus cross-sectional area in circular mils; I = fault current to ground, also resistor rating in amperes when only one neutral is grounded; S = duration of current flow in seconds.

*Currier and Rhodes: *Power Plant Engineering*, June 1, 1927.
Morse: *Power Plant Engineering and Design*, D. Van Nostrand Co, Inc, New York, 1946.



More KVA per pound with *Pennsylvania* POLE STAR TRANSFORMERS *because*

The 100 Kva Pole Star weighs less than Pennsylvania's old design, 75 Kva transformer. The 75 Kva Pole Star weighs less than the former 50 Kva (and even less than the old 37½ Kva transformer). The 50 Kva Pole Star weighs less than the former 37½ Kva, and so on down the line . . . to the smallest Kva sizes.

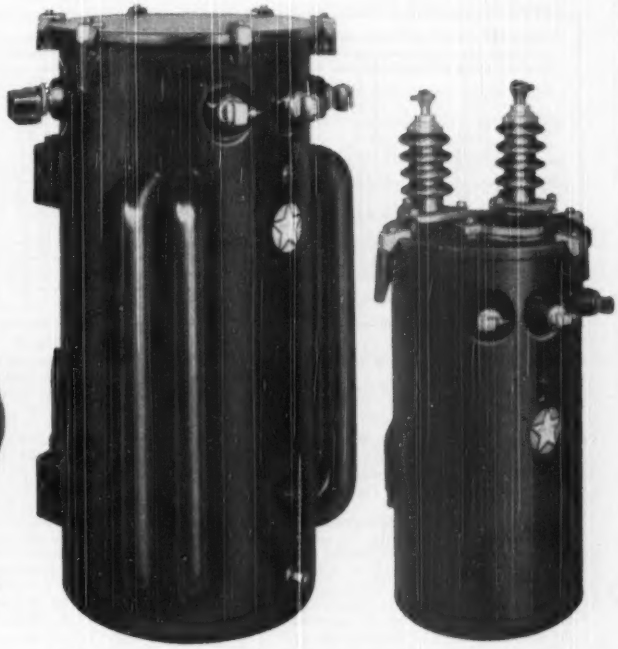
THIS MEANS you get more Kva per pound when you install Pole Stars on your lines. It further means that when you must increase the size of your transformers to carry heavier loads, you may be able to replace your present transformers with larger Kva-rated Pole Stars, with little or no increase in weight. This may save you the expense of changing from Hanger mounting to Platform mounting, and it may eliminate the necessity of replacing existing poles with heavier poles.

POLE STARS are lighter....

Wound Core POLE STARS *Cold Rolled Steel Cores*

3	Kva —	43 lbs. lighter
5	Kva —	65 lbs. lighter
10	Kva —	110 lbs. lighter
15	Kva —	150 lbs. lighter
25	Kva —	220 lbs. lighter
37½	Kva —	470 lbs. lighter
50	Kva —	445 lbs. lighter
75	Kva —	405 lbs. lighter
100	Kva —	735 lbs. lighter

than old design Stacked Core Pennsylvania Transformers *Hot Rolled Steel Cores*



50 Kva *Pole Star* with 2400 Volt side-issuing H. V. bushings.

10 Kva *Pole Star* with 15 Kv cover-mounted bushings.

Let the **POLE STAR** be your guide . . .

Product Of Long Experience

Safe Thrifty And Reliable

PENNSYLVANIA POLE STAR TRANSFORMER

Pennsylvania
TRANSFORMER COMPANY
CANONSBURG, PENNA.
Greater Pittsburgh District

Transformer Primary and Secondary Connections

Diagrams indicate frequently used wye and delta primary connections, also single-phase and three-phase secondary connections for lighting and power. This is an adaptation from construction methods of Pacific Power and Light Co, Portland, Oregon.

WYE PRIMARY

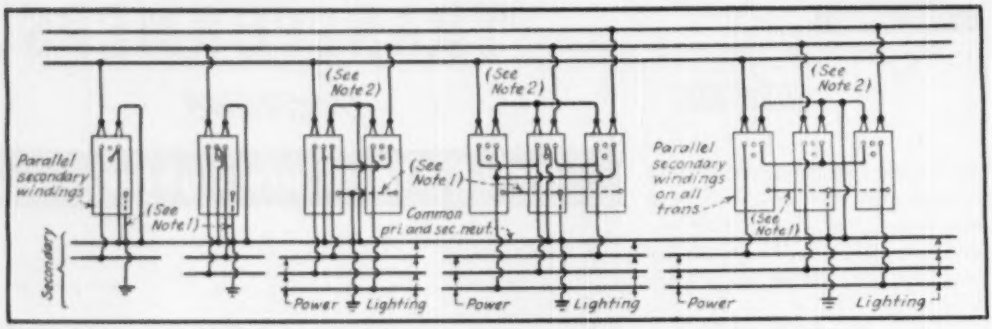


FIG 1 1-ph, 2-w sec

FIG 2 1-ph, 3-w sec

FIG 3 3-ph, 2 transformers, 4-w combination lighting and power, open delta

FIG 4 3-ph, 3 transformers, 4-w combination lighting and power, delta

FIG 5 3-ph, 3 transformers, 4-w combination lighting and power, wye

DELTA PRIMARY

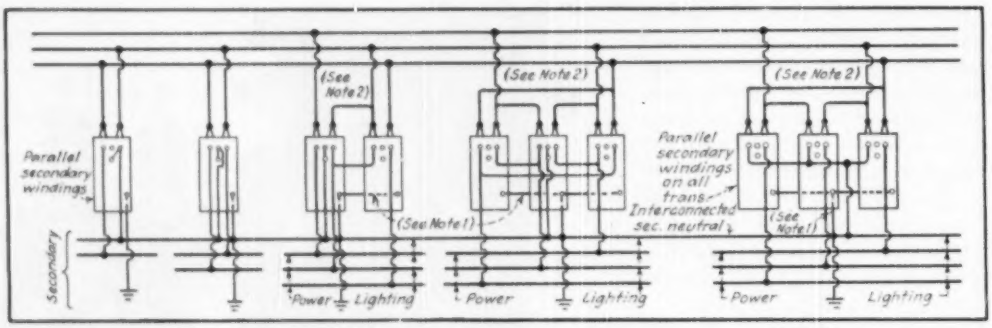


FIG 6 1-ph, 2-w sec

FIG 7 1-ph, 3-w sec

FIG 8 3-ph, 2 transformers, 4-w combination lighting and power, open delta

FIG 9 3-ph, 3 transformers, 4-w combination lighting and power, delta

FIG 10 3-ph, 3 transformers, 4-w combination lighting and power, wye

NOTES **1.** Good neutral and grounding connections are even more important than primary connections. Above schematic diagrams are not necessarily intended to show exact neutral and grounding connections. These connections should be made as follows:

A—In the case of a single-phase or open-wye installation or a grounded neutral wye primary circuit, run unspliced, untapped and as direct as possible from proper transformer primary terminal (or primary neutral bus in case of open-wye) to neutral line wire.

B—Run grounding wire unspliced from grounding electrode to grounding stud of one of uppermost pieces of equipment or devices on pole, or to neutral wire if it is in highest position. Other grounding connections, except as in "A" above, are to be tapped to this grounding wire in most suitable manner. Be sure that line neutral (or service neutral wire if there is no line neutral) is connected to grounding wire with unspliced connection as short as is practicable.

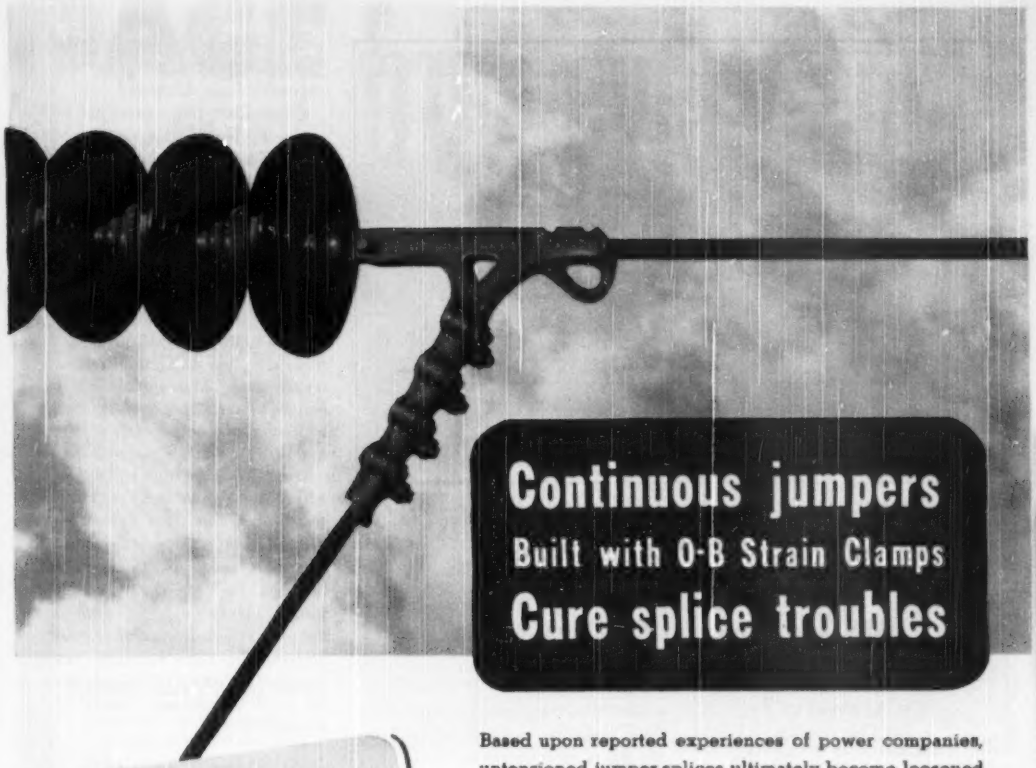
C—Run connection unspliced from transformer secondary neutral terminal which is to be grounded to neutral line wire (or to service neutral wire where there is no line neutral).

D—Connect terminal of transformer secondary neutral to be grounded to secondary grounding pad where such pad is on transformer tank. Be sure other transformers in the same 3-phase bank have this connection removed.

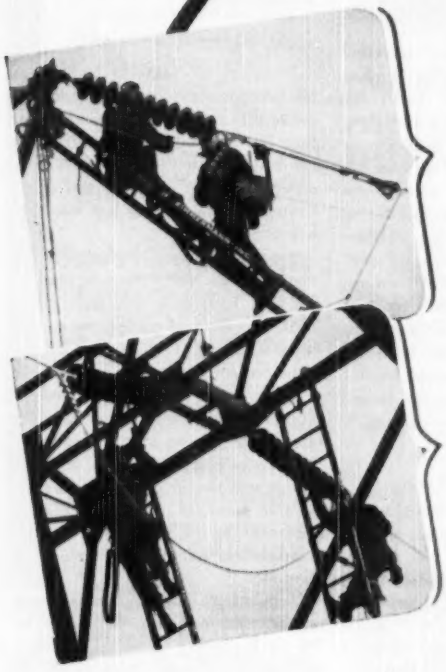
E—Grounding or neutral connections, if run on arm, shall be on under side.

2. Primary connections are arranged as shown to give better clearance on actual installation on pole. Note secondary connections are transposed wherever primary is transposed.

3. Above secondary connections are for 120/240 and 120/208-v classes.



Continuous jumpers
Built with O-B Strain Clamps
Cure splice troubles



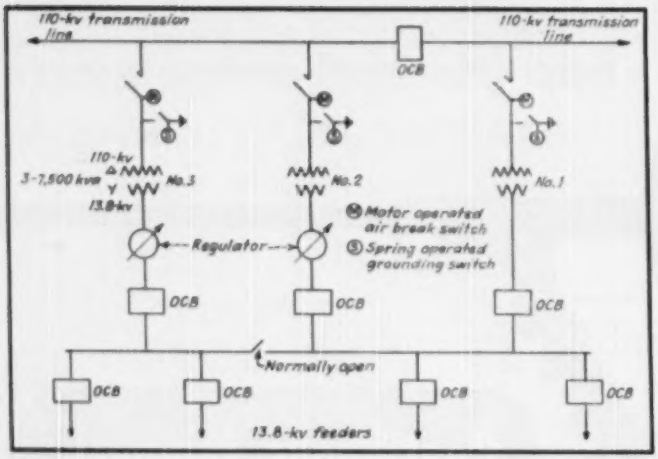
Based upon reported experiences of power companies, untensioned jumper splices ultimately become loosened and corroded, leading to burn-down. This can be avoided by the practice of stringing conductor straight through all strain points, thus producing continuous jumpers and eliminating a serious source of line trouble.

For this purpose the O-B strain clamp is ideal. Its holding power without slip is beyond all permissible conductor tensions. It is easily installed by a two-man crew, without special tools, equipment, or skill. Its attachment is subject to complete inspection at installation and during later maintenance checkups. Its final cost is low, while the value of continuous jumpers in preventing transmission failures can't be computed!

Build your transmission lines with O-B strain clamps to avoid spliced jumpers. Gain the advantage of a permanent low resistance electrical path from terminal to terminal--at a substantial saving in cost.

Ohio Brass

MANSFIELD · OHIO



SPECIAL CONNECTION at the Westwego Substation of Louisiana Power & Light Co permits one 110 kv OCB to do the work of four breakers and utilizes one 13.8 kv regulator to do the work of two. OCB is, in effect, interposed between paralleled No. 1 and 2 transformers

OCB and Regulator Do Double Duty

H. L. DELONEY
Asst Chief Engineer
Louisiana Power & Light Co

One 110-kv OCB performs the functions normally assigned to four breakers; and one 13.8-kv regulator performs the work of two at Louisiana Power & Light Company's Westwego Substation. This 110—13.8-kv substation has a capacity of three 7,500-kva transformers.

Special Circuit Required

As shown in the simplified line diagram, No. 1 & 2 transformers operate in parallel on both the high voltage and low voltage sides. However, the 110-kv OCB is in effect interposed between the two on the 110-kv side. Two sets of carrier relaying, with standard impedance and ground backup protection are provided on the 110-kv breaker, one set pointing in each direction. The low-voltage breaker on each transformer is connected to trip with the 110-kv OCB upon operation of the relays pointing into the line section on which that transformer is connected. Since the station is in a transmission loop, this provides a two-way feed to the low-voltage bus. Conventionally this would be accomplished by the use of two breakers, one breaker being placed on each incoming line.

Under fault conditions operation is as follows: The remote breaker on the line section in fault, the 110-kv OCB and the associated low-voltage breaker on the transformer trip simultaneously, leaving the opposite transformer to supply the 13.8-kv bus. The remote OCB recloses automatically, the 110-kv breaker recloses on automatic synchronism, and after a short time delay, the low voltage breaker recloses automatically. If the fault is permanent the three breakers lock-out. However, provision is made in the station to manually switch the transformer to the opposite line section if the load demand requires it.

Relaying Cut In

It will be noted that No. 3 transformer normally is operated on the same high-voltage bus as No. 2, and independently on the low voltage side. However, when the bus-tie is closed to parallel No. 3 with the other two, it is automatically cut in to the relaying scheme outlined above. (No. 3 transformer which supplies less essential portion of the area load is not normally operated in parallel with the No. 1 & No. 2 transformers due to excessive fault currents.)

Gains from this scheme are further realized when transformer protection is considered. Standard ratio differential relays are provided for transformer protection. Operation of these relays causes the tripping of a single pole, spring-loaded, solenoid operated ground switch. This causes the line to which the transformer is connected to relay out on a ground fault, the low-voltage breaker having been tripped by the differential relay. The transformer high-voltage switches, being motor operated, they open while the line-section is dead, thereby not being required to interrupt fault current. After the high voltage switch, which not only isolates the fault transformer or bus but also the ground switch, is open the line is reenergized automatically on time delay as in the case of a line fault, the station 110-kv OCB reclosing on the automatic synchronizer. Again, to perform the same functions conventionally, a 110 kv oil circuit breaker on each transformer would be required.

Four OCB's Saved

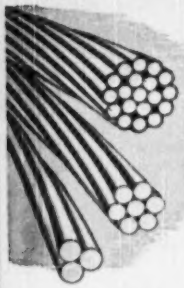
Although the relaying and control circuits are considerably complicated under this arrangement, the saving of four 110-kv oil circuit breakers (and associated switches, etc) more than offset any other expenses and disadvantages. Performance has been satisfactory.

Another unusual feature is the regulator on No. 2 transformer. A 750-kva, 10% raise and lower regulator, this piece of equipment is used to control the 13.8-kv bus fed by transformers No. 1 and No. 2. Held to 5% lower or raise, by reconnecting regulator limit switches to limit the circulating current, an effective range of 5%, 2½% up and 2½% down is maintained on the bus. This is sufficient to maintain a very flat 13.8-kv bus with the regulation for 110-kv transmission line being obtained at this point.

Circulating current created with regulator in maximum 5% boost or 5% buck position raises the kva load on one transformer from 6,100 to 6,500 kva and lowers the other from 6,100 to 5,800 kva.

PAGE

Stainless Steel
STRAND
and
Stainless-Copper
CONDUCTORS



Here's WHY they Save

Compared with other types strand of equal breaking strength, they . . .

- have 30-40% greater overload capacity within elastic limit
- resist corrosion all the way through —not merely through a thin case of soft metal
- offer highest tensile and vibration-fatigue strength (tensile strength 235,000 psi; corrosion-fatigue limit 50% of ultimate)

Here's HOW they Save

- They permit longer spans—therefore require fewer poles per mile.
- Being lighter, they are easier and faster to install in the field.
- More resistant to destructive factors, they last many times as long before replacement.

Let us tell you the whole story—
specific data, prices, recommended sizes.

ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Pittsburgh, Philadelphia, Portland, San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

from every angle

there's a good reason for choosing the

CHANCE ~~STEEL~~ 8-Way Expanding Anchor

Here's what the men who buy and use them say. *Linemen*—"We don't have so much weight to carry."—"It takes fewer licks to expand."... *Foremen and Construction Superintendents*—"We do save some time and labor."—"There's no danger of breakage."—"We can tell when this anchor is expanded."... *Storekeepers*—"They're easy to handle."—"Your colored identification tag is a big help."... *Engineers*—"We can depend on the uniformity of steel."—"You've taken full advantage of all the area."—"Our tests show it has surprising strength."—"The cone shape is a good idea—you get a wedging action."... *Purchasing Agents*—"Any time we can satisfy ourselves on quality at a price we like—we're happy."... *Management*—"We've seen convincing proof that our lines are going to stay put with your 8-Way in the ground."... You get more for your money in the Chance 8-Way Expanding Anchor.

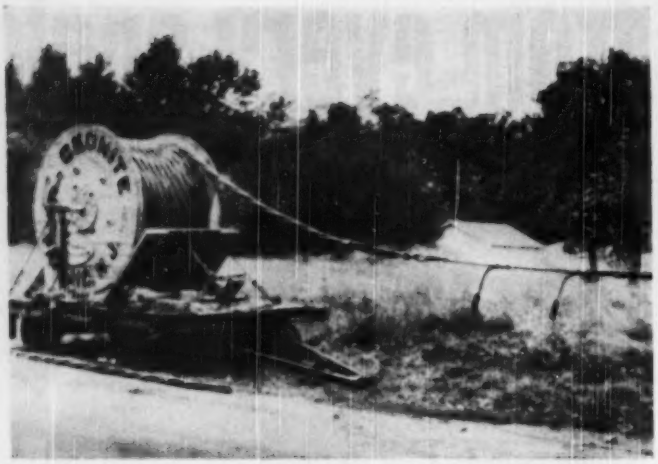
C50-00

ABC INDUSTRIES

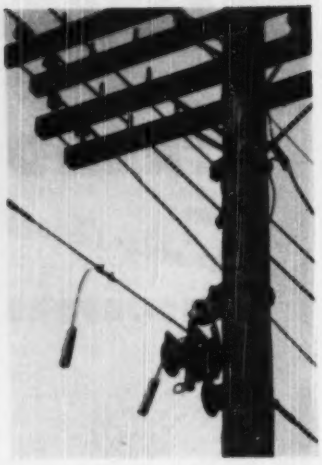
Now know it's RIGHT when you specify CHANCE

A. B. CHANCE CO.

CENTRALIA, MISSOURI • SAN FRANCISCO, CALIFORNIA



ANTI-TWIST DEVICE is inserted in pulling line between cable grip and ball-bearing swivel. Without twisting, cable can be sagged in and secured when pulling-in is completed



ONE WEIGHT prevents twisting while other weight goes through pulley block

Weights Prevents Twisting of Aerial Cable

TWISTING of pre-assembled, self-supporting aerial cable during pulling operations can be prevented by attaching a weighted device to the pulling line just ahead of the cable grip. Although twisting does not injure the cable, its prevention is desirable because it gives the cable an unsightly appearance. Attached as described above, the device eliminates twisting and saves the time formerly spent straightening twists before messenger could be sagged and secured.

The desire for an anti-twist device arose because an occasional twist occurred, even when ball-bearing swivels were inserted between the pulling line and cable, due to friction in the swivel or the tendency of the cable itself to untwist. Developed by Rhea P. Lapsley of The Okonite Co, the device consists of two pendulum-like weights secured in tandem to a short section of messenger. Weights are attached by preformed spring steel strips which allow them to pass through the pulley block without being snagged. Two weights are necessary, and are spaced so that one weight remains suspended below the cable while the other passes through the block. In operation, the weighted messenger section is inserted between cable messenger and pulling line.

During an installation of about 2½ miles of 15-kv aerial cable, Jersey Central Power & Light Co used this anti-twist device. Even though the cable was 3¼-in. in diameter and weighed 6 lb per ft, it was pulled-in and strung without any twisting of messenger or cables.

Inspection and Maintenance of Fire Extinguishers

FIRE extinguishers are inspected by the distribution department of an eastern utility during the first week of each month. Units on company cars are cared for by the garage superintendent. Maintenance of all units is the duty of a repair shop foreman.

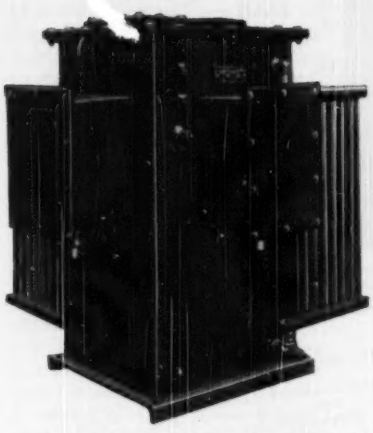
Whenever a fire extinguisher is inspected or refilled, the names of the inspector and refiller, and the date, are recorded on a tag attached to the unit. A completely-filled tag is replaced at the next inspection, with the information in the spaces marked "Station", "Ext No." and "Type" copied on the new tag. Detached tags are filed for one year by the department under "Special Tests and Records" and then destroyed. Every defective extinguisher is taken to the repair shop and a fresh replacement drawn from stock. The shop foreman decides whether repairs are feasible or junking is advisable.

Testing tetrachloride extinguishers (except the pressure type) requires operating the pump and noting whether or not a satisfactory stream of liquid is produced. The approximate amount of liquid in the extinguisher is determined by shaking it. If the amount of liquid is found to be substantially below capacity, the unit is replaced. In inspecting pressure type tetrachloride units, the liquid level and air pressure are observed. If the liquid level is below the gage glass or the air pressure is under 75 psi, the deficiency is corrected by adding liquid or pumping up the air pressure to 100 psi. These tetrachloride units are refilled by the inspector.

Part I presents inspection and maintenance responsibilities; inspection of carbon tetrachloride extinguishers. Part II covers inspection of soda-acid and Foamite extinguishers.

DISTRIBUTION Transformers

The Dependability you demand, in the types and sizes you need.

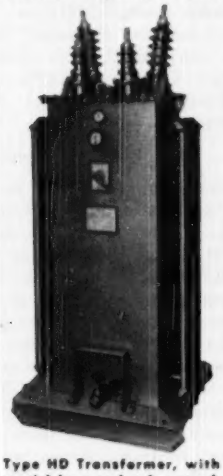


Large Uptegraff Distribution Transformer, with radiators and enclosed junction boxes. Askarel immersed.

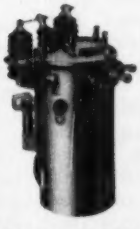
Long life and dependability are built into Uptegraff Distribution Transformers through sound design and rugged construction. Available in sizes from 1½ to 500 KVA, up to and including the 69 KV Class. Types include air-cooled dry types, as well as oil or askarel immersed transformers. The units shown here are representative of Uptegraff designs.

Uptegraff is well-equipped to promptly serve individual specialized needs as to capacity, rating and dimensions. We will be glad to have our nearest representative call at your convenience, to discuss your transformer problems.

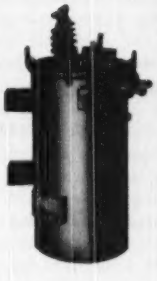
Large air-cooled distribution transformer, for indoor service.



Type HD Transformer, with special base and valve guard.



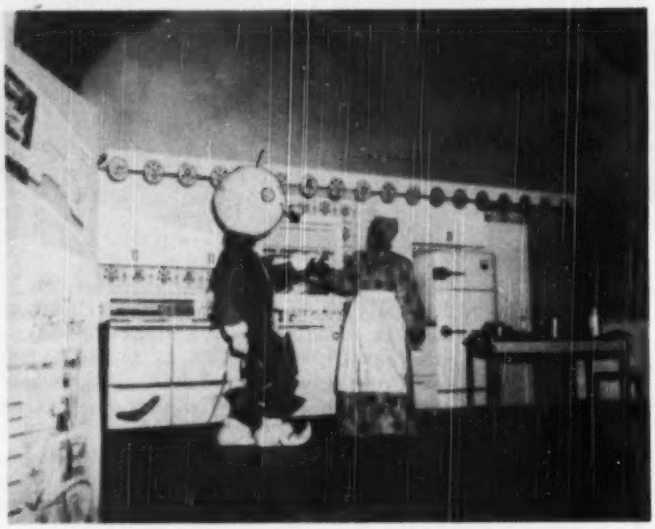
Above—25 KVA self-protecting, pole-mounted transformer. Right—Distribution transformer with cover-mounted high voltage bushings.



R. E. UPTEGRAFF

MANUFACTURING CO.

Scottdale, Penna.



SKIT featuring Reddy Kilowatt (Clyde L. Stewart Jr.) and Mammy (Betty Watson) proved popular and effective in electric range promotion. Dealers were given facts on range saturation

Dallas Power and Light Opens Drive To Boost Range Sales

DALLAS Power & Light Co has opened a five-year campaign to boost electric range sales in Dallas. The program was launched by supplying all dealers and distributors with facts about the national range saturation and market as compared with saturation, market and age of stoves now in service in Dallas.

Skit Proves Effective

The power company's several hundred employees have been organized as "Reddy's Rangers" and are assisting in bringing the story of electric cooking and its many advantages into the homes of their friends and acquaintances. The "Rangers" turn in the names of prospects for electric ranges, with all information that will help in closing the sale. When a prospect results in a sale the "Ranger" submitting it is paid $5.00.

A wide variety of the accepted sales promotion tools has been called into play in the Dallas campaign. One that has been most effective is the one-act skit, "What's Cookin', Reddy?", written and presented by the home service and advertising staffs of the company.

Theme of the skit emphasizes advantages of the electric range. The two characters are Reddy Kilowatt and an old fashioned negro mammy. Both parts are played by employees.

Reddy wears a suit of tights dyed bright red. His head, specially built, is an exact replica of the Reddy Kilowatt figure. Shoes and gloves are also in Reddy's style. Mammy does most of the dialogue which is spoken rhythmically to the tune, in part, of "Short'nin Bread."

Setting is an all-electric kitchen with Mammy humming and making so-called "short'nin bread." As she puts the bread into the oven, Reddy pops up from behind the range and Mammy introduces him. Mammy tells Reddy to get to work. He hides himself behind the range and does not appear again until the last verse when he and Mammy present the ten selling points of the electric range.

Display Selling Points

The ten points are colorfully printed on ten separate placards. They are individually announced, in turn, by Reddy and Mammy, and held by members of the home service staff, each girl wearing the official uniform. After all girls are on stage, Reddy invites the audience to join in and sing the chorus with them.

This skit was developed to present the range sales campaign to the company's sales department employees. It was received so enthusiastically it was used with dealers and proved so popular there that, by request of dealers, it is being put on with some of their customer groups.

As an added incentive to dealer salesmen, the power company offers a special bonus of $2.50 for each electric range sold during the campaign provided the dealer matches it with an additional $2.50 of his own. This is designed to build added enthusiasm among salesmen.

An extensive advertising program has been planned. In it, outstanding electric kicthens in Dallas will be featured, pictorially and through testimonials.

Other Promotional Steps

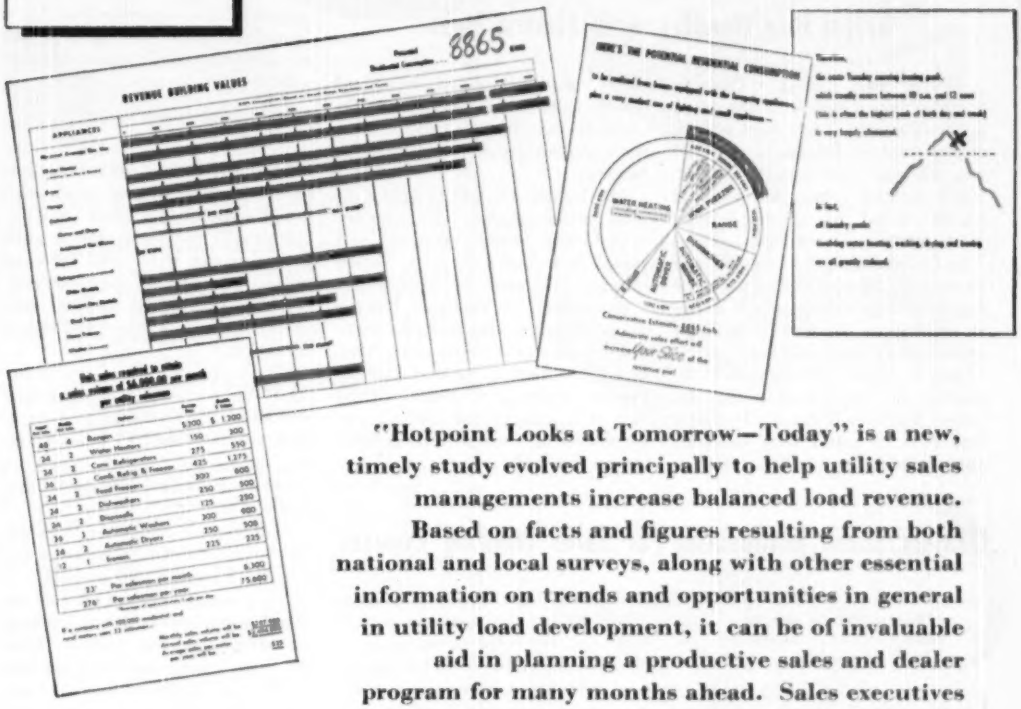
Television is being used as an important part of the advertising program: Shows are being televised direct from the home service cottage of the Dallas Power & Light Co featuring in turn each make of electric range. Distributors feature their dealers in these broadcasts. This helps establish the dealer as the headquarters for electric ranges in his neighborhood. Other promotional features include sales training programs, cooking schools, handbooks and selling aids, home service follow-up and plan books for dealers.

"...an excellent guide in helping to solve the many load balancing problems which undoubtedly confront most utilities today."

SUTHERLAND DOWS
President, Iowa Electric Light and Power Co.,
Cedar Rapids, Iowa

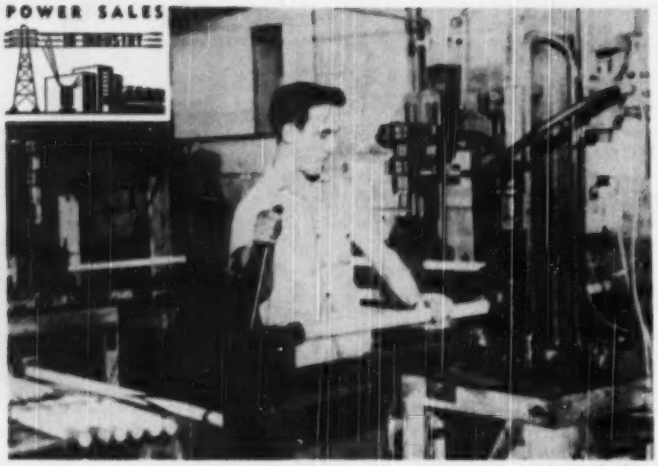
Hotpoint LOOKS AT TOMORROW TODAY

Thanks, Mr. Dows—it was planned largely for that particular purpose.



"Hotpoint Looks at Tomorrow—Today" is a new, timely study evolved principally to help utility sales managements increase balanced load revenue. Based on facts and figures resulting from both national and local surveys, along with other essential information on trends and opportunities in general in utility load development, it can be of invaluable aid in planning a productive sales and dealer program for many months ahead. Sales executives interested in having an individual or group presentation of this study made are requested to contact the Hotpoint Utility Division, Hotpoint, Inc., 5600 West Taylor Street, Chicago 44, Illinois.

Hotpoint Inc.
(A GENERAL ELECTRIC AFFILIATE)



General Electric Co Photo

REPLACEMENT HANDLES for garden tools are spliced in electrically-heated presses

Splice Hoe Handles with Electric Heat

BUYING new garden tools, you wouldn't take a hoe or rake that had a spliced handle. You'd want a good, strong, solid handle. But for a busted hoe that had been kicking around, you'd probably reason that a spliced handle would be strong enough. That's what the Union Fork and Hoe folks in Columbus, Ohio, figured, and by so doing they opened up a market for short lengths of good ash timber in replacement handles. They did it with the help of electric heat.

Ash is scarce and expensive. In making tool handles it is cut and turned into round dowels 5 to 6 ft long and all pieces with knots or other defects are rejected. This resulted in large accumulation of dowels from which shorter lengths could be cut. Why not splice these short pieces together for replacement handles?

The lengths are spliced with a V-joint bonded together. The joints are coated with bonding material and placed in an hydraulic press. In the clamps of the press are 1,000-w cartridge heaters, 2 in the upper, 2 in the lower. A thermostat bulb in the lower clamp controls the temperature. After 60 sec, the press is released with the bonding material thoroughly dried and set and the spliced handle ready for the curing room with no holding clamps required.

Dealers Show Enthusiasm For Sales Training Courses

J. D. ALFORD
Residential Sales Manager
Public Service Co of Indiana, Inc
Indianapolis

IN PREPARATION for a period of aggressive load building activities, Public Service Co of Indiana has been conducting sales training courses with dealers and their sales personnel for more than two years. Foundation of this training has been the Edison Electric Institute Basic and Residential Sales Training Course. W. C. Brown was appointed as coordinator, and acted as instructor in many of the training courses which were held over a wide area in order to reach as many sales people as possible in the company's 623 communities, spread over 70 counties.

In order to assure best results, 19 sales supervisors attended a three-day instruction course "How To Conduct a Conference Meeting," under the direction of Dr. John Brickner at Indiana University. To place a value on the course by dealers, each dealer was charged $7.50 for each enrollee, which was the actual cost of the 12 manuals used in the course. The company defrayed all other expenses such as the records and films at $300 per set, projection equipment, blackboards and instruction personnel.

Twenty-five sales training classes were conducted by the company's 15 sales supervisors. In order to standardize teaching methods and make experiences of each class beneficial to all other classes, a news bulletin was published by the general sales department in Indianapolis. The bulletin contained items on all classes including new methods of leadership developed, dramatic review ideas for preceding lessons and sales trends in the state and national market.

To date 576 dealers, dealer salesmen and dealer saleswomen have completed the training course. It is estimated that within the next year an additional 500 dealer salesmen will have completed the course.

Certificates Issued

To assure good attendance in the classes, certificates were issued only to those attending nine or more of the 12 sessions. To attach some significance to the certificates, graduation exercises were held for most classes. Banquet dinners, with leaders in the sales field as speakers, were given the classes at the conclusion of the course.

Many dealers who have either taken the course or had their sales staff attend the meetings, are loud in their praise of the EEI Sales Training Course.

Gilbert F. LaRue, a dealer in New Castle says:

"Our electric appliance sales the first 10 months of 1949 exceeded the sales for the entire year of 1948

". . . a large percent of this increase in business is due to training our sales personnel received from EEI Sales Training Course sponsored by the local Appliance Dealers Association and the Public Service Co of Indiana."

Jack C. Finney of the H. J. Schrader & Co, Inc, Kokomo, says:

"Had it not been for this course, it would probably have taken me years of practical experience to gain this knowledge."

NOW... from your electrical dealer... get Polyken No. 163 ELECTRICAL TAPE

in these 3 Convenient Packs

...beats "friction tape" 8 ways!

...gives you 8 "extras" at no extra cost!

- **Sticks quicker (higher "tack")**
- **Greater dielectric strength**
- **Cleaner than friction tape. Doesn't pick up dirt or soil hands**
- **Unwinds easier**
- **Doesn't fray**
- **Less bulky, adequate yet strong**
- **Better moisture barrier**
- **Sticks firmly to any clean surface**

Now . . . for no more than you have been paying for ordinary friction tape . . . your electrical dealer will supply you with 8-ways-better POLYKEN No. 163 electrical tape . . . in your choice of three convenient put-ups.

A thin but tremendously strong cloth-backed tape, No. 163 is a pleasure to work with. It unwinds easily, sticks quickly, firmly. The cloth backing is *not* sticky. Thinness plus high dielectric strength means neater, less bulky splices and wraps. Yet No. 163 costs you no more than most ASTM friction tape.

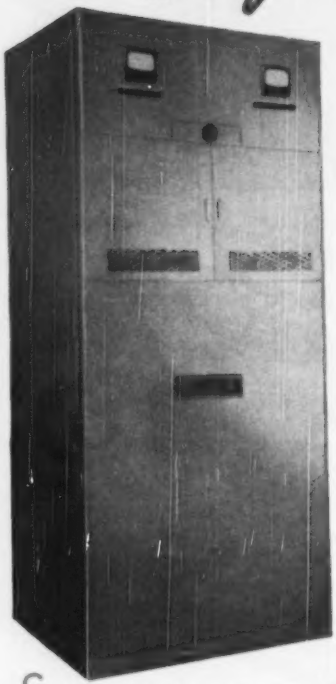
Call your electrical dealer today!

Polyken® INDUSTRIAL TAPE

DEPARTMENT OF
BAUER & BLACK
DIVISION OF THE KENDALL COMPANY
222 W. ADAMS ST., CHICAGO 6

Here's a Battery Charger that is

Completely Self-Contained



- All components in one cabinet
- No separate units to install
- Cuts installation costs

Starting contactor, voltage and current controls, transformer, filter components, rectifier, meters and protective devices—all components necessary for battery charging and control are contained in the heavy sheet metal cabinet of the PECo Battery Charger . . . Compact design eliminates the necessity of installing separate starter and control panel and the interconnection of power and control circuits . . . AC input and DC output leads may be brought in from the top, simplifying conduit installation . . . There are no moving parts . . . No fans or other ventilating equipment required . . . No special foundations necessary.

Write for full information.

POWER EQUIPMENT *Company*

Specialists in Controlled Rectifiers Since 1935

55 ANTOINETTE STREET / DETROIT 2, MICHIGAN

INDUSTRIAL BRIEFS

Germicidal Lamps Safeguard Drinking Water purity at the Sparkletts Drinking Water Corp in Los Angeles, Calif. Twenty of these 30-w tubular lamps are installed to cover every step of the production where bottles or water are exposed to the air. Another 20 of these lamps are used in a specially designed cylindrical sterilizer through which the water passes for a final intensive sterilization just before going into the sterilized bottles.

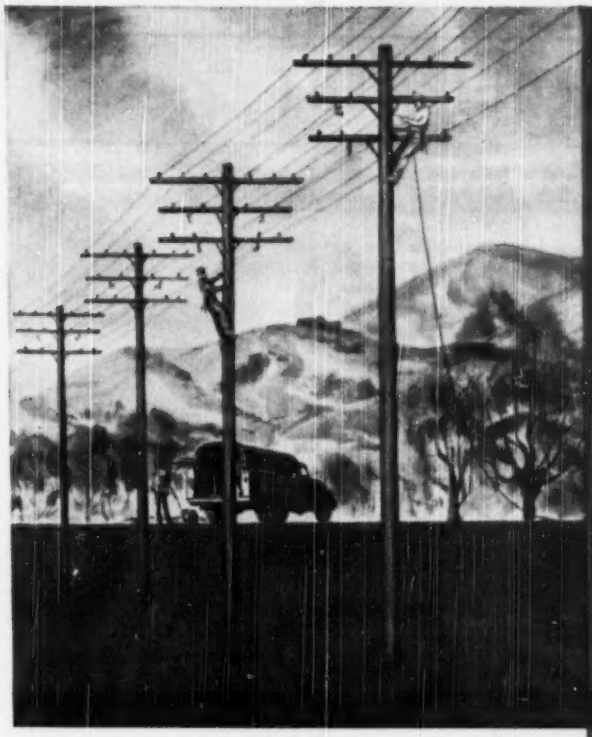
Infrared Cuts Degreasing Costs, increases efficiency and produces a more uniform job at the Lawson Mfg Co Pittsburgh, Pa. Seventy-two kw in all-metal electric radiant heaters have replaced the previously-used vapor method of degreasing 31 by 20 in. sheet metal parts. A continuous conveyor carries parts thru the infrared oven that removes all traces of oil in 36 sec. Heated section of oven is approximately 3 ft long and the conveyor moves at 5 ft per min.

Twin-Drive Motors replace a 15,000-hp twin-tandem, cross compound steam engine used on the 206-in., 4-high mill at the Lukens Steel Co, Coatesville, Pa.

The new electric motor twin-drive consists of two 4,000-hp, 30/75 rpm, 600-v reversing motors; one directly connected to the top work roll and the other to the bottom work roll of the mill. The new twin-drive will have a continuous torque rating of 1,400,000 lb-ft and a maximum torque rating of 3,850,000 lb-ft.

New High Intensity Approach Lights at Washington National Airport, combined with new high intensity runway lights, ILS, and GCA will help reduce "minimums" and increase number of completed flights. The approach lights consist of 60 units of the 14 ft long "slope line" fixture, each having 10-200-w sealed beam lamps—replacing 14 old style neon approach lights, which consumed about 100-w each.

The 75 new high intensity runway lights are uni-directional, each having two 95-w sealed beam lamps—replacing about 70 semi-flush type which used 30-w lamps. Total increase in load amounts to approximately 130-kw.



for over-all protection

Specify **penta-protected POLES**
chlorophenol

Leading light, power and telephone companies are using poles treated with PENTA in constantly increasing quantities. There's a good reason for this trend—for PENTAchlorophenol has many advantages.

PENTA protection is *clean* protection—permits a *full length* preservative treatment with no fear of complaint from customers or line crews. PENTA gives long lasting *proved* protection against decay and termites. Its remarkably low solubility and volatility mean it stays in the wood under the most adverse conditions.

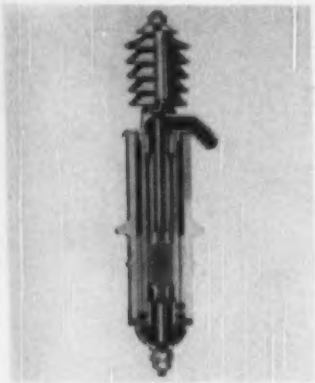
For the "over-all treatment" specify PENTA. For more information about this *modern* wood preservative, write to Dow, Dept. PE 40.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

THE CLEAN WOOD PRESERVATIVE

DOW
penta-
chlorophenol

NEW EQUIPMENT



Lightning Arrester

THE AUTOGAP lightning arrester has been brought out in a vertical design that reportedly incorporates all the essential features of the older horizontal model. While it does not replace the horizontal model, it is intended for installations where the vertical type is necessary or desirable. Other than physical arrangement of parts, the only difference between the models is that the process of expulsion acts vertically instead of horizontally. Manufacturer states that, like the horizontal type, it extinguishes the follow arc before it reaches the first current zero. The arrester is made in three sizes with voltage ratings of 3, 6, and 9 kv.

Hubbard & Co, 6301 Butler St, Pittsburgh, Pa.

•

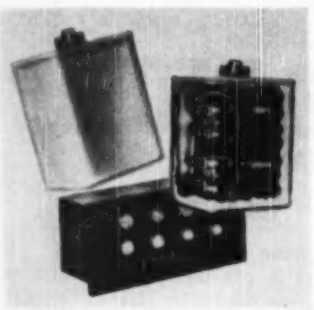
Servicing Platform

A TRUCK-MOUNTED double-jointed steel boom with a self-leveling platform suitable for servicing street lights or other work up to 33 ft above ground is now available. Flexibility of the articulated boom allows the platform to swing at the same time on a radius of 20 ft in an arc of 180 degrees ahead of the rear wheels, over which the boom is pivoted. Hydraulic power to operate the device is supplied by a conventional power take-off from the truck engine, and is controlled by the operator through finger-tip levers located on the platform.

Lifting capacity on a standard one-ton truck chassis is 500 pounds, but with stabilizers or outriggers the platform can lift up to 800 pounds to any position. Top speed is six seconds from ground to maximum height of 33 ft. All operating cylinders incorporate balancing valves so power can be shut off at any time, leaving the boom stationary in any position. As soon as hydraulic pressure is restored, the boom may be moved again. In case of emergency the platform can be operated from the ground.

Stemm Bros, Inc, Leavenworth, Wash.

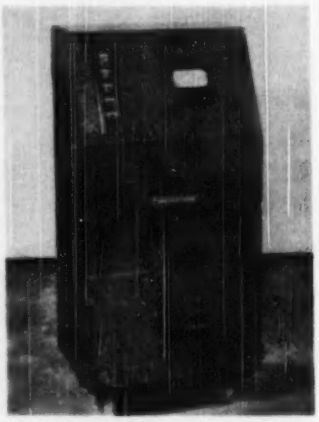
•



Alarm Signal System

FOR ALARM SIGNALLING SYSTEMS in hazardous locations or corrosive atmospheres, Panalarm Series 400 units have hermetically-sealed relays on a sealed plug-in octal socket. These alarm systems can be used for electrical or mechanical equipment operation, monitoring speeds, time cycles, pressures, temperatures, or liquid and gas flow. The sealed units containing the relays are filled with an inert gas and reported to operate at less than 10 deg above room temperature. In other respects the Series 400 is similar to the company's Series 300.

Panalarm Products, Inc, 7216 N. Clark St, Chicago 26, Ill.



Insulation Tester

AN INSULATION TESTER is available to assist in the development and control of insulating coatings for copper wire, and other applications involving dielectric stress studies. The tester consists primarily of a high-voltage transformer, a motor-driven autotransformer, an indicating voltmeter, and mercury cups or terminals for connecting the specimens.

Standard rate of rise of the secondary voltage is 500 v per sec, controlled automatically. At breakdown of the specimen insulation, an over-current relay operates to stop the motor driving mechanism and open the primary to de-energize the circuit. A timer permits fatigue testing to be done.

Two models are available: one rated at 35 kv, 5 kva; the other at 12 kv, 0.5 kva. Cabinet dimensions are 20x16x35 in., and over-all weight is about 300 lb.

Westinghouse Electric Corp, P.O. Box 2099, Pittsburgh 30, Pa.

•

Neoprene Jacketed Cable

Portable electrical cords and cables with jackets certified to contain not less than 60% by weight of new Neoprene

Once Again
HUBBARD
Leads the Field!

A NEW WOOD STRAIN INSULATOR with

Direction of pull indicated by large arrows

Small arrows indicate the resultant forces on wood member when strain is applied. Pressure is inward on all four sides of the wood. (Patent Pending)

As tension is applied to the new Hubbard Wood Strain Insulator, the interlocking plates start moving forward. As they move slightly, the inclined planes under the heads and nuts of the assembly bolts cause a simultaneous motion inward, 90 degrees to the line of pull, and on all four sides of the wood member. In older designs the "squeeze" has been applied transversely in two opposing directions only, which results, under excessive pull, in a crushing and "flowing" of the wood fibres until a limit is reached where the bolts shear out of the wood.

With the Hubbard 4-way design, the "squeeze" is from all four sides. There is no relief area into which the wood can "flow." Consequently, the fittings hold to the full strength of the wood member. Tremendous holding power has been achieved by this development. Pulled to destruction, no fractures have occurred under a fitting but always in the clear part of the wood. For the first time, a wood strain insulator is available with perfectly designed fittings and at a low cost.

HUBBARD AND COMPANY

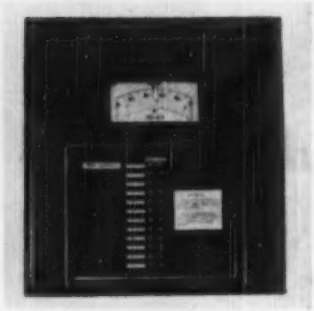
PITTSBURGH
CHICAGO

OAKLAND
CALIFORNIA

are said to have longer aging characteristics, higher resilience, and greater resistance to oil, ultra-violet, ozone, abrasion, heat, cold and flame. The Bronco 60 certified line consists of 1 to 8 conductor cords and cables in a wide range of sizes, including Types OS, W, and G Heavy Duty cables; welding cables, Types OSJ, OSV, drive-in theater, and Type RR cables.

Western Insulated Wire Co, 1001 E. 62nd St, Los Angeles 1, Calif.

•

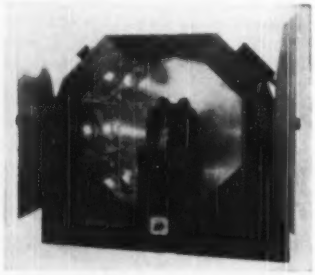


Tank Gage System

ONLY FOUR LEADS are reportedly required for each tank to be gaged with an electronic precision remote reading tank gage system. There are no field relays or junction boxes needed since each transmitter is directly connected to the receiver. The system uses a 110-v ac source, reduced to 6.3 v for energizing the measuring circuit. The Brown Electronik Precision Indicator is incorporated in the system, said to be adaptable for both low and high pressure storage tanks.

Shand & Jurs Co, Berkeley, Calif.

•



Infrared Oven

ESPECIALLY ADAPTABLE to motor repair work because of the short time cycle required to bake a motor is the Model 72-648 infrared oven. For example, fractional horsepower motors can be baked out in less than 45 min, and 1 to 5 hp motors, either armatures or stators, can be done in one hour. The 12-socket oven will accommodate a product 12x12x18 in.

Top of the oven is louvered to permit escape of solvent vapors or moisture. An adjustable product-holder is provided. Two extras, a temperature meter and timer, important for some uses of the oven, may be obtained.

The Fostoria Pressed Steel Corp, Fostoria, Ohio

•

Factory Heating Pad

SUGGESTED USES for a new molded rubber, thermostatically controlled electric heating pad for floors include: Protection from cold, drafty floors for machine operators; checkers in markets; gatemen; cashiers, and office workers. Warming of trays of chemicals in the darkroom and tools so they will be warm when grasped are other possible uses. The pad is 14x22x$\frac{3}{32}$ in., uses 150–200 w, and is equipped with a 6-ft cord for plugging into 110-120-v receptacles.

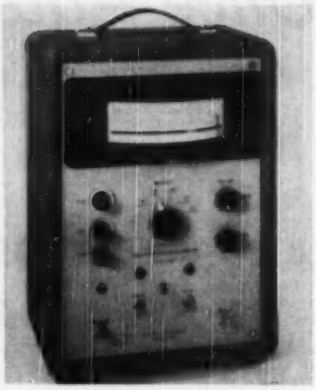
Thermo Mat Co, 814 S. Robertson, Los Angeles 35, Calif.

•

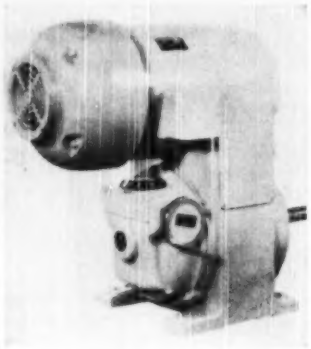
Megohmmeter

THE 20-MILLION MEGOHMMETER is an instrument designed for precision measurement of electrical resistance over a range from 300,000 ohms to 20,000,000 megohms. There are two test potentials of 85 and 500 v dc. The overall range is divided into six decades which are switch-controlled. Power supply required is from 110 to 115 v, and 190-260 v ac. The 6-in. edgewise meter is provided with a mirror scale and knife edge pointer. Short-circuit current is said to be limited to 2.5 ma on the 500-v supply and to 5 ma on the 85-v supply. Further details are given in Bulletin 1029.

Herman H. Sticht Co, Inc, 27 Park Pl, New York 7, N. Y.



•



VARIABLE SPEED MOTOR — The Speed-Trol motor is now available in the Klosd-Tite fan-cooled design for dusty or damp places. Cooling is by forced draft ventilation with an external fan, protected by a fan cover. Speed can be controlled either by means of the fingertip control on the motor or through mechanical, electrical or lever-type controls. Ratings are from ½ to 25 hp.

Sterling Electric Motors, Inc, Telegraph Rd at Atlantic Blvd, Los Angeles, Calif.

•

Humidity Recorder

A PORTABLE TEMPERATURE and relative humidity recorder, Model 160, is intended primarily for installing, testing, servicing, and selling of industrial equipment such as heating or air conditioning.

The charts are 3x5 in. for a 30-hr

MORE NEW EQUIPMENT

Just Received

Appearing Next Issue

HIGH-VOLTAGE INDICATOR
Portable electrostatic indicator for 20 kv line-to-ground

LAND CLEARING MACHINE
Trees and undergrowth reduced to fragments in 6-ft swath

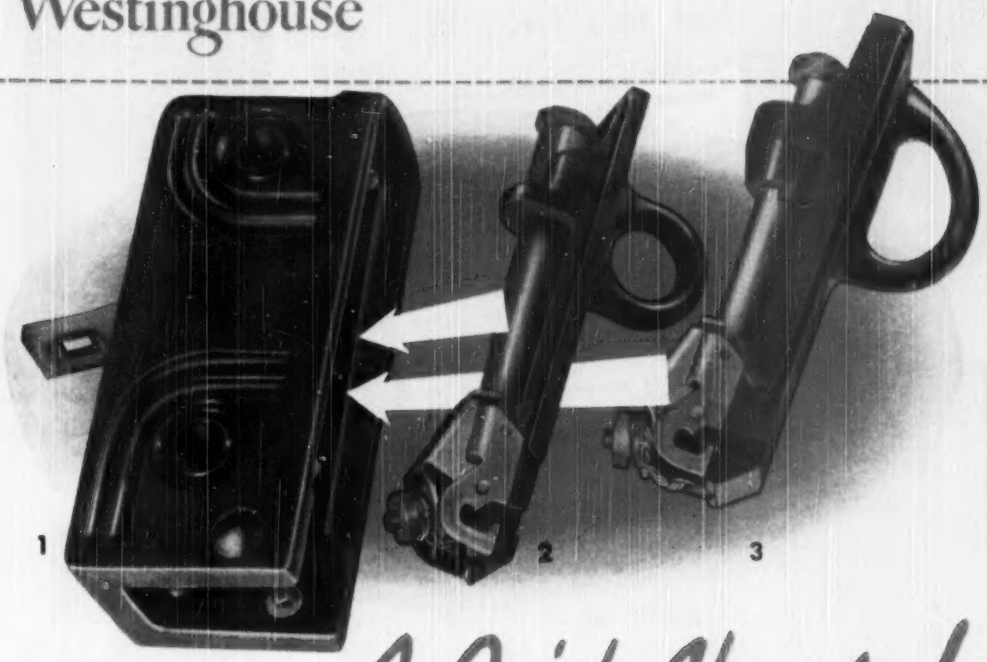
POLYETHYLENE INSULATION
Used on aluminum line wire; free stripping and no festooning

THREE-PHASE RECLOSER
For rural systems, it has 3,000 amp short circuit capacity

OUTDOOR LIGHTING PACKAGE
All-aluminum unit packages for switch yards, industrial plants

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



A Quick Changer!

. . . for fast re-fusing . . for higher capacity

Interchangeability keynotes Westinghouse porcelain-enclosed cutouts. Only Westinghouse gives you this versatility in line protection. Consider what this means:

First, fuse replacements are fast . . . safe . . . easy. Lineman removes door with hookstick—replaces it with a fused door. Fuse links can be replaced at the truck or in the shop.

Second, as line capacity outgrows the cutout interrupting rating, the EA cutout door may be replaced with the new Type HC (high interrupting capacity) door—either dropout or non-dropout type. That's because *any* door will fit *any* housing.

In addition, you get greater safety; complete hookstick operation; 180° dropout for clear indication of blown fuse; cool operation; light weight combined with great mechanical and electrical strength.

These cutouts are available now in a range of sizes to meet your requirements. See the versatility of this cutout. Ask your nearby Westinghouse representative or distributor for a personal demonstration and Booklets B-3833 and B-4299. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-60705

1. PRESTITE PORCELAIN HOUSING—50-ampere, 5-kv, identical for both Type EA and Type HC cutouts.

2. MOLDARTA TYPE EA DOOR—1,200-ampere interrupting capacity.

3. MOLDARTA TYPE HC DOOR—Interchangeable with Type EA cutout door. Interrupting capacity 8,000 amperes at 2,500 volts, 5,000 amperes at 5,000 volts.

Westinghouse

FUSE CUTOUTS

FOR ANY SYSTEM

NOW! the transformer of the future

ELECTRICAL WORLD

FUTURE POSSIBILITIES

. . . It is to be expected that such activity (improvements) will continue in the future. Much of it can probably not be foreseen at this time. There are a few items, however, which might be mentioned as either distinct possibilities or highly desirable.

There is considerable promise of the production of a dry-type distribution transformer for pole top installation. The advantage will be less weight and lower maintenance. It seems possible that on such a transformer the case might be reduced to a minimum or perhaps be eliminated entirely.

MARCUS

DRY TYPE AIR COOLED

LIGHTER! SMALLER! SAFER! MORE ECONOMICAL!

AIR-COOLED TRANSFORMERS EXCLUSIVELY

1 to 3,000 KVA up to 15,000 Volts to meet individual Requirements

- DISTRIBUTION
- GENERAL PURPOSE
- UNIT SUBSTATION
- PHASE CHANGING
- ELECTRIC FURNACE
- RECTIFIER
- WELDING
- MOTOR STARTING

Write for Bulletin #49-ACO

MARCUS TRANSFORMERS CONFORM TO THE STANDARDS OF N E M A AND A I E E

Representatives in Principal Cities

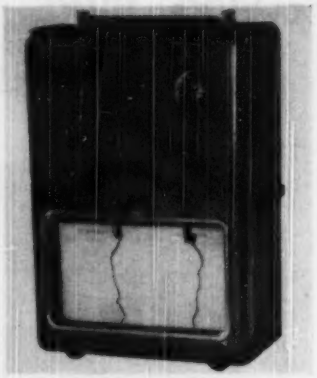
COMPETITIVE PRICES MTC GOOD DELIVERIES

MARCUS TRANSFORMER CO. INC.

32 MONTGOMERY STREET

HILLSIDE 5, NEW JERSEY

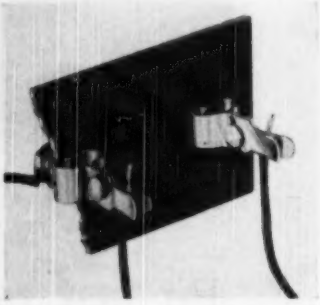
PIONEERS IN THE FIELD OF AIR-COOLED TRANSFORMERS



record, and move vertically downward in the case. Standard temperature range of the spring driven recorder is 0 to 110 F, and relative humidity range is 10 to 95%.

Friez Instrument Div, Bendix Aviation Corp, Baltimore 4, Md.

•



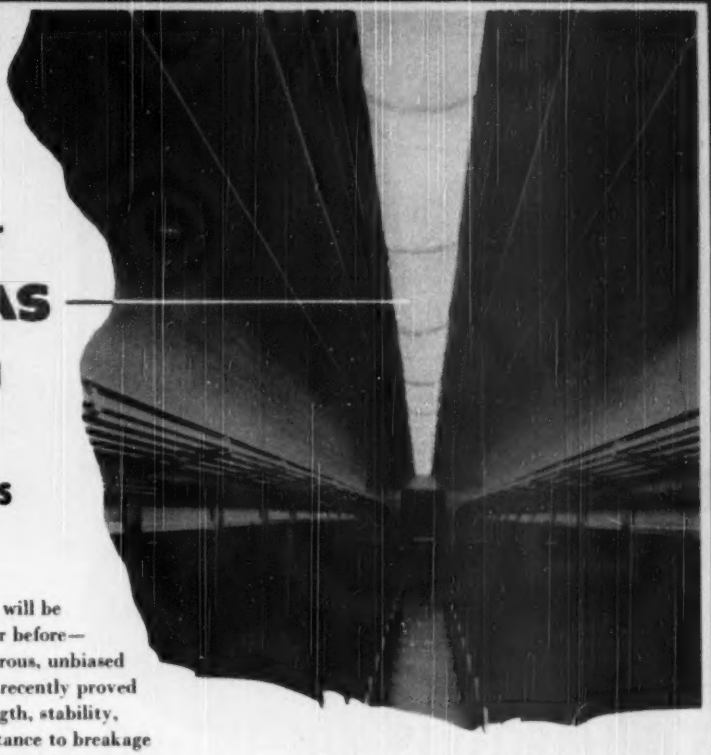
TEST CLIP—For expediting testing of assembly line products, this test clip can be permanently mounted on the panel of test equipment, or, for single applications, mounted temporarily. Leads are slipped in or out of the clamp type jaws, spring action holding the wire.

Grayhill, 4524 W. Madison St, Chicago 24, Ill.

MORE NEW PRODUCTS about which you should know

THE SUPERIOR ELECTRIC CO, HANNON AVE, BRISTOL, CONN., has introduced the Varicell to provide a regulated source of **variable** dc voltage from 0 to 30 v, and current output at any voltage setting of 15 amp; operates from 95 to 135 v, 60 c. . . . H-B INSTRUMENT CO, DEPT T-59, 2633 TRENTON AVE, PHILADELPHIA 25, PA., has two models of a **Thermo-regulator:** one for controlling the temperature range 30 to 600 F, the

Railroads Prefer PLEXIGLAS for Car Lighting Over All Other Types of Plastics



Here is a typical railway car lighting installation of translucent white PLEXIGLAS. Safety Car Heating & Lighting Company, New Haven, Conn., chose tough acrylic PLEXIGLAS because of its light-diffusing qualities, high impact strength and ability to withstand repeated shocks. In this application, PLEXIGLAS forms a combination fluorescent ceiling trough and conditioned air distributor.

Entire fleets of railway cars will be better lighted now than ever before—because of PLEXIGLAS. Rigorous, unbiased tests of "lightable" plastics recently proved PLEXIGLAS superior in strength, stability, optical properties, and resistance to breakage and vibration. And already several famous railroads are specifying this acrylic plastic in their new equipment.

In railway service, lighting fixtures undergo the most severe tests. Requirements are:— Low unit weight; good dimensional stability; expansion or contraction of less than 1/32-inch per 3-foot length for every 15° F. change in temperature; strength enough to bear the weight of baggage; life equal to that of the railway car; flexibility enough to permit shields to be snapped into position in fixtures; excellent light transmission qualities (at least 82% in 0.06-inch thickness of diffusing material); and the ability to withstand vibration.

PLEXIGLAS met every one of these requirements (where other types of "lightable" plastics failed). And PLEXIGLAS offers other "plus" advantages:— Resistance to age and discoloration from fluorescent lights; ease of forming, machining and installation; low cost maintenance; choice of colors, patterns and transparencies, translucencies or opacities.

SEND FOR FREE LITERATURE TODAY

Reprints of an article, "Plastics for Railway Car Lighting" and detailed information on many other lighting applications of PLEXIGLAS are available for the asking. As the first step toward better lighting in vehicles, offices, factories, banks, send for your copies today.

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries

PLEXIGLAS is a trade-mark, Reg. U.S. Pat. Off. and in principal foreign countries.

Canadian Distributor: Crystal Glass & Plastics, Ltd., 282 St. Helens Avenue, Toronto, Ont.

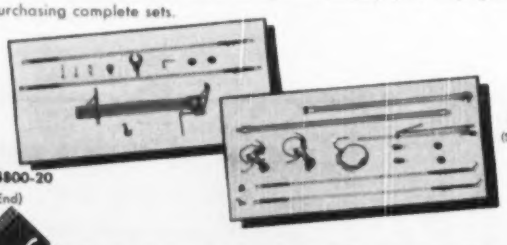
CHANCE Aluminum Fitted HOT LINE TOOLS

Complete Sets

for any Live Line Maintenance Job make selection easy and save you money!

There is a Chance Hot Line Tool Set to handle any live line maintenance job—three phase, or single phase, on straight line or dead end—from 4,000 volts on up. Chance Tool Sets provide the utmost in safety to linemen and meet all requirements for strong, lightweight, easy-to-operate tools.

Tool Set M4800-15, pictured above, contains all equipment needed for making pole changes, cross arm changes, and insulator changes on three phase construction. Other sets, with fewer tools, for changing insulators and making pole changes on single phase ridge pin construction, and for making dead end insulator changes on either poles or cross arms, are also available. Sets may be purchased complete, or as separate items. You can save money and simplify your buying by purchasing complete sets.



Tool Set M4800-14 (Single Phase)

Tool Set M4800-20 (Dead End)

ABC INDUSTRIES

A. B. CHANCE CO.

CENTRALIA, MISSOURI • SAN FRANCISCO, CALIFORNIA

other covering −38 to about 50 F. It is said to control to 0.01 deg through a relay that can handle up to 30 amp at 110 v ac.

MINNEAPOLIS-HONEYWELL REGULATOR CO, 2953 FOURTH AVE, S, MINNEAPOLIS, MINN., has a **temperature control** for industrial processing; range is between −20 F and 300 F and control is reportedly unaffected by dust and dampness . . . NATALE MACHINE & TOOL CO, 339 STATE HIGHWAY NO. 17, CARLSTADT, N. J., has an emergency **portable floodlight** which uses interchangeable 200, 300, or 500 w sealed beam lamps, or infrared weatherproof lamps.

CALIBI MANUFACTURING CO, INC, 45 WASHINGTON ST, WEST ORANGE N. J., has a **soldering gun** with a single-pole electrode that features trigger-controlled dual heat (150 w or 1,000 w); designated the Cal-88. . . . CALF-TERIA SALES, INC, FORT WAYNE, IND., offers an electric **stock waterer** that provides water automatically when livestock nose down a treadle in base of the bowl; primarily for freezing weather.

POTTER INSTRUMENT CO, INC, 136-56 ROOSEVELT AVE, FLUSHING N. Y., has developed a high-speed predetermined electronic **counter** featuring direct dial setting of the predetermined count; counts at rates up to 60,000 per min. . . . OIL-RITE CORP, 3475 S. 13TH ST, MILWAUKEE 15, WIS., has a solenoid operated **chain oiler** for automatically lubricating conveyor chains.

THE CARPENTER STEEL CO, READING, PA., has introduced a chrome-nickel **stainless steel** that reportedly remains non-magnetic after severe cold working and has application in making parts for precision instruments. . . . MULLEBACH ELECTRICAL MANUFACTURING CO, 2300 E. 27TH ST, LOS ANGELES, CALIF., is offering the Pushmatic, a single-pole device for **controlling** and protecting circuits of 120 v a-c; also approved for two-pole operation at 120-240 v a-c, 15 to 50 amp.

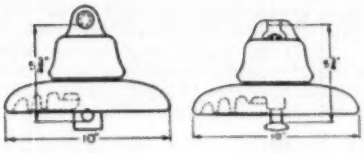
DEN-EL EQUIPMENT CO, 271 CONKLIN AVE, HILLSIDE, N. J., is making **lamp guards** said to prevent injury, poisoning or damage to machinery due to falling fluorescent lamps. . . . GENERAL ELECTRIC CO, SCHENECTADY 5, N. Y., has an **oven-temperature tester** for checking and calibrating gas and electric oven-thermostat indications against actual oven temperatures; instrument is a dc millivoltmeter, scale range from 0 to 650 F.

GENERAL SWITCH CORP, 45 ROEBLING ST, BROOKLYN 11, N. Y., is producing 30-amp front-operated, toggle, plug fuse

Left: Installing Victor suspension insulators on a power line in the Southwest

Install Victor Suspension Insulators

FOR DEPENDABLE ON-THE-JOB PERFORMANCE



No. 800
Clevis type

No. 900
Ball and socket type

VICTOR No.		800 and 900
60 cycle dry flashover	KV	80
60 cycle wet flashover	KV	50
Pos. impulse flashover	KV	125
Neg. impulse flashover	KV	130
Dry arcing distance	In.	7⅝
Leakage distance	In.	11⅝
Impact rating	In. Lbs.	55
M and E strength	Lbs.	15000

CONTINUOUS, trouble-free insulator service *counts* when it comes to *lower* maintenance and replacement costs on transmission lines. That's why more and more successful power companies are *specifying* Victor suspension insulators.

Even under the most severe service conditions, you can rely on Victor's rugged suspension insulators for years of uninterrupted transmission. *Each* one is rigidly inspected and tested at *every* point of manufacture, and must *easily* meet *all* NEMA standards. For you this means dependable performance *on the job!*

Get All the Facts! **CALL YOUR VICTOR REPRESENTATIVE**

J. A. Perkins Co., *Boston, Mass.* • T. B. Dally, *Jersey City, N. J.* • L. Morris Landers Co., *Atlanta, Ga., Charlotte, N. C.* • Continental Sales & Engineering Co., *Pittsburgh, Pa.* • H. J. Schwarberg, *Cincinnati, O.* • David D. Schneider, *Louisville, Ky.* • Brainard & Bair, *Detroit, Mich.* Homer G. Hall, *Princeton, Ind.* • Gaide & Dunlap, *Chicago, Ill.* • E. B. Rouner Co., *Minneapolis, Minn.* • Fred B. Hearn, *St. Louis (Affton), Mo.* • Chas. L. Ward Co., *Kansas City, Mo.* • Southwest Sales & Service Co., *Shreveport, La.* • George E. Turbox, *Denver, Colo.* • Myron Swenchon, *Boise, Ida.* • Maydwell & Hartzell, *San Francisco, Cal., Los Angeles, Cal., Portland, Ore., Seattle, Wash.*

Also distributed nationally by Line Material Company

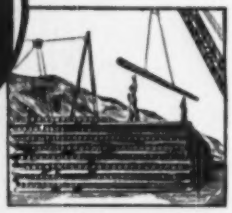
VICTOR
INSULATORS Inc.
VICTOR, NEW YORK

Look for this trade mark of enduring service

V

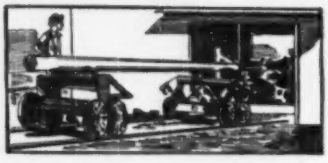
BAXCO LONG-LIFE DOUGLAS FIR PRESSURE TREATED LONG POLES

For over 50 years J. H. Baxter & Co. with its Associated Pacific Coast Companies has specialized in the production and sale of exceptionally long (up to 125 feet) Wood Poles for the electric power, lighting and telephone utilities . . . Stocks in all lengths are complete — shipments prompt!



PROPER SEASONING

BAXCO poles are carefully seasoned in dry, clean yards. Proper pre-conditioning before Pressure Treatment adds years of longer life.

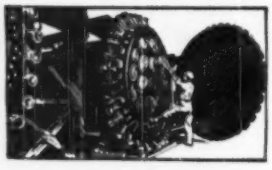


MACHINE SHAVING

To produce smoother and more uniform poles, the BAXCO process includes machine shaving. This removes small swells and results in a more round, evenly tapered product.

PRESSURE TREATMENT

Deep penetration and high retention of the preservative is a hallmark of the BAXCO Pressure Treatment Method.



Get the Full Story! Write today for this BAXCO BOOKLET

J. H. Baxter & Co.

333 MONTGOMERY STREET · SAN FRANCISCO 4, CALIFORNIA

ASSOCIATED COMPANY: J. H. BAXTER & CO., OF OREGON

safety switches; can be used as disconnect switches for industrial equipment and residential appliances. . . . P. R. Mallory & Co, Inc, 3029 E. Washington St, Indianapolis 6, Ind., offers a 6-v portable dc **power supply**, Type 6RS10, for testing and demonstrating magnets, solenoids, relays, etc. It is equipped with a 0-20 amp dc ammeter, 1-10 v dc voltmeter, self-resetting circuit breaker and other protective parts; operates from 110-115 v ac.

C. P. Clare & Co, 4719 W. Sunnyside Ave, Chicago 30, Ill., is offering a dust-tight plug-in **enclosure** for its small Type "J" relay. . . . Andrew Corp, 363 E. 75th St, Chicago 19, Ill., has announced a $\frac{3}{16}$-in. diam, semi-flexible coaxial **cable**, Type 83, for communications applications.

Micro Switch, Freeport, Ill., has announced its No. 1AH2 normally-open pendant **switch** and No. 1AH3 normally-closed pendant switch for 10 amp ac, $\frac{3}{4}$ hp motor at 115 v, or $1\frac{1}{2}$ hp motor at 230 v ac. . . . Fischer & Porter Co, Hatboro, Pa., is manufacturing the Magna-Sight **flow gage** that can be used to indicate rate of flow of oil to oil-cooled transformers or electroplating solutions through filters and water to rinse tanks.

Hewlett-Packard Co, 395 Page Mill Rd, Palo Alto, Calif., has a **power supply** for providing variable plate and bias supply voltages as well as ac voltages to 500 v for general laboratory use. . . . Hewlett-Packard Co also has a general purpose **pulse generator** for testing "fast" circuits and making checks of other generators, RF circuits, peak-measuring equipment.

W. L. Maxson Corp, Unimax Switch Div, 460 W. 34th St, New York 1, N. Y., offers a snap-acting **switch**, Type SXXX, rated at 15 amp, 250 v ac; 20 amp, 125 v ac; $\frac{3}{4}$ hp, 125, 250, 460 v. . . . Quality Control Co, 6356 Hollywood Blvd, Los Angeles 28, Calif., is marketing a **height gage** scope combining the features of a telescope with a microscope for measuring dimensions which can be seen but not touched.

General Electric Co, Pittsfield, Mass., has announced that a technical report has been published on a new **silicone dielectric** compound, called G-E 81083, intended for use as waterproof, dielectric sealing compound. . . . The Hertner Electric Co, 12690 Elmwood Ave, Cleveland 11, Ohio, has an accessory for automatically **charging two batteries** simultaneously from the company's single-circuit motor generator battery charger.

BOTH CARRY 390 AMPS.

BUT ROCKBESTOS A.V.C.® IS 43% SMALLER

With higher-rated A.V.C. and a 390 ampere load INSTALLED COSTS ARE LOWER*—

- **you use a 400 MCM cable *not* 700 MCM**
- **you use 3″ conduit *not* 3½″**
- **you use *smaller* fittings and lugs**
- **you have *lower labor costs* because smaller, lighter cable and conduit are quicker and easier to handle.**

Size for size A. V. C. has a HIGHER AMPERE RATING

Hi

. . . YOUR BEST BUY

Permanently-insulated Rockbestos A.V.C. can save you money. Write for the booklet "Cut Current Carrying Costs."

*Comparison with Type RH based on Chapter X—National Electrical Code, 40°C-104°F Ambient

ROCKBESTOS A.V.C.

ROCKBESTOS PRODUCTS CORPORATION
New Haven 4, Connecticut

NEW YORK • CLEVELAND • DETROIT • CHICAGO • PITTSBURGH
ST. LOUIS • LOS ANGELES • OAKLAND, CAL.

Trends in POWER

· GENERATION
· DISTRIBUTION
· UTILIZATION

HERE ARE THREE Allis-Chalmers answers to demands for efficient and economical equipment in the face of rising fuel, labor and construction costs.

They are typical of Allis-Chalmers advanced designs employed in *all* major apparatus for electric power. It will pay you to call our nearby representative and have him show you why "A-C is a good name to know in electric power."

New Bucket Wheels, Baffles for 40-yr. Old Turbines Up Efficiency 8%

Three turbines — record capacity for those days—were installed for a west coast utility by Allis-Chalmers in 1908. Each was a 10,750 hp double overhung impulse turbine for 250 rpm (50 cycles) under 865 ft head.

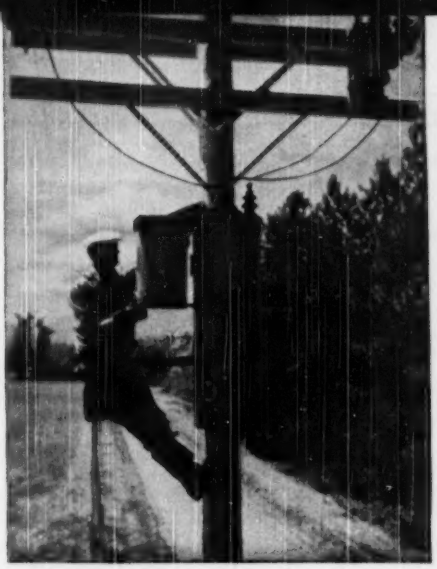
They were recently reconstructed on the basis of new bucket wheels and baffles for a 60 cycle speed of 300 rpm. Power house tests show these wheels now have best efficiency of 90%. This is 8% higher than the original wheels furnished 40 years ago.

Restoring or bettering original performance of hydraulic turbines offers opportunities for increasing capacities, efficiencies and span of service. Allis-Chalmers has facilities and experience to render this service.

Equipment for Power: Water Conditioning equipment, chemicals and service... Steam and Hydraulic Turbines... Generators... Condensers ... Steam Jet Air Ejectors ... Power Plant Pumps and Motors ... Transformers... Circuit Breakers... Switchboards and Control ... Switchgear ... Unit Substations ... Utilization equipment.

ALLIS-

Pioneers in Power and



The California Oregon Power Co. Improves Rural Voltage with New Pole-Type Regulator

Stepped up demands for power are bringing new voltage problems to once adequate lines in many parts of the country. The newest solution to these problems is the pole-type Allis-Chalmers ⅝% step JFR regulator, shown here, of The California Oregon Power Co. feeder. It holds a ± 1 volt band, provides ± 10% range of regulation.

The new Allis-Chalmers JFR regulator offers utilities for the first time a low cost way of really regulating — not just boosting — voltage on rural lines. In addition to providing improved voltage and better service, the JFR increases revenue, or permits the extension of feeder lines without expensive rebuilding!

Unequalled Accessibility In New Unit Substation For West Penn Power Co.

This new 1500 kva single circuit unit substation recently installed by West Penn Power Co. has convenience features found only in Allis-Chalmers unit substations.

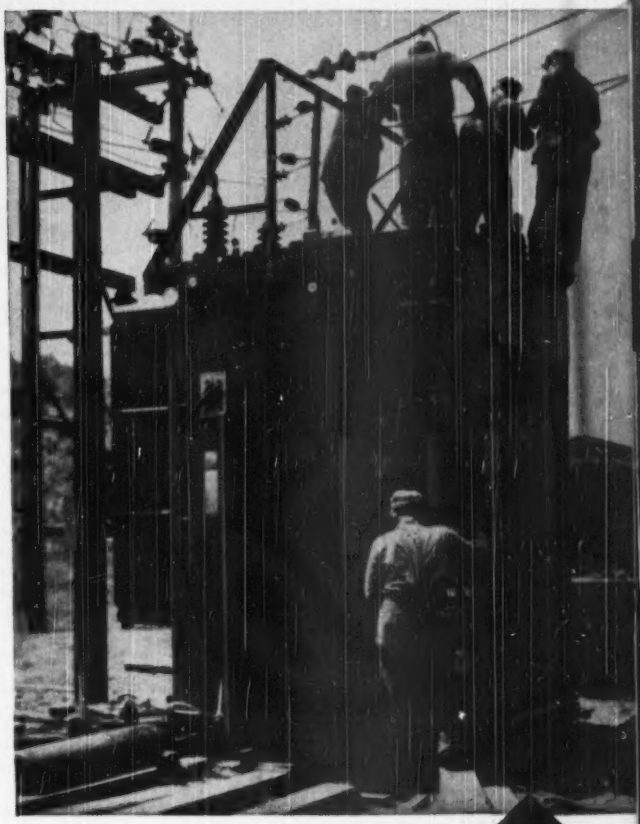
It is unequalled in accessibility. For example: both potential and control power transformers are drawout mounted. Permit removal without interrupting service. Doors at front and rear permit easy access to switchgear. Features like these meet today's need for speedy inspection, maintenance, and routing tests. Cut shutdown time.

The Allis-Chalmers single circuit unit substation is a completely self contained package made up of transformer, switchgear, regulator, controls, meters, and relays . . . designed for easy installation — reliable and quiet operation.

If you have a power distribution problem which you feel can best be solved by a unit substation — load center, single, or multi-circuit — rely on A-C's broad engineering experience in this field. Call your nearby A-C representative *early* during the basic planning stage.

A-2984

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.



CHALMERS

A-C ALLIS-CHALMERS

Electrical Equipment From Generation Through Utilization

NEWS ABOUT PEOPLE

Faden Named Chairman of New England Group

James L. Faden, of Boston Edison Co's electric and steam sales department, has been elected chairman of the

JAMES L. FADEN

Power Engineers Association (New England).

Other new officers of the association are H. H. Memmott, Connecticut Light & Power Co, vice-chairman, and H. S. Fisher, Central Vermont Public Service Co, secretary and treasurer.

Faden has been with Boston Edison since 1921. Earlier he had been employed by Lockwood, Green & Co, Boston consultants, in textile mill and power plant work and by Fred T. Ley Co, Springfield, Mass., on electrical design and applications in the construction field.

Chairman of the electric heating section of the Electric Institute of Boston, Inc, Faden also is a registered professional engineer and member of the American Welding Society, New England Foundrymen's Association, and American Metal Society. Since his term as chairman of the old National Electric Light Association's national industrial heating committee, he has become known for his activities in this branch of central station service.

•

C. Allon Clift, Arkansas Power & Light Co Southwest division manager, has been promoted to assistant to AP&L Vice-President R. E. Ritchie. He will be succeeded by **W. C. Alley,** assistant division manager. Clift has been with the company almost 25 years and has been Southwest division manager for 2 years. Alley, who has been with the company 20 years, started as a line foreman. He was assistant to the Northeast division manager from 1934 to 1941, when he moved to the same position with the Southwest division.

•

Vice-Presidents Elected by Ford, Bacon & Davis

Thomas I. Crowell, Jr, and Charles B. Cooke have been elected vice-presidents of Ford, Bacon & Davis, engineers-constructors, of New York, Chicago, Philadelphia, and Los Angeles.

Cooke started with Ford, Bacon & Davis in 1911. He has had charge of many comprehensive studies of the problems of transportation and electric utility companies dealing with operations, reorganizations, regulation, and modernization programs. During World War II he was the firm's representative in charge of the design of the Army's Bermuda Air Base, Post, and Kindley Airfield, including its highway and power facilities. He is a registered professional engineer in New York and Pennsylvania.

Crowell joined the organization in 1936 and since 1948 has been manager of the report department, which makes surveys and reports for clients on business, management, and technical problems. He is a director of the company and also of its wholly owned subsidiary Ford, Bacon & Davis Construction Corp.

•

Herman F. Bahmeier, a construction engineer for the Bureau of Reclamation, has been transferred from Davis Dam to the Delta district of the Central Valley Project to direct the Bureau's construction work on American River development. Bahmeier has spent 20 years on western Reclamation projects. He supervised the construction of Island Park Dam in Idaho, Vallecito Dam and the San Luis Project in Colorado, and Davis Dam and power plant on the Colorado River. During the war he directed the early stages of construction of Anderson Ranch Dam, highest earth-fill dam in the world.

IGE Names Earl Givens Vice-President for Sales

Earl C. Givens has been elected a vice-president of International General Electric Co. He will be responsible for

EARL C. GIVENS

sales and marketing, succeeding Edward F. Callahan, who is retiring after 44 years with GE.

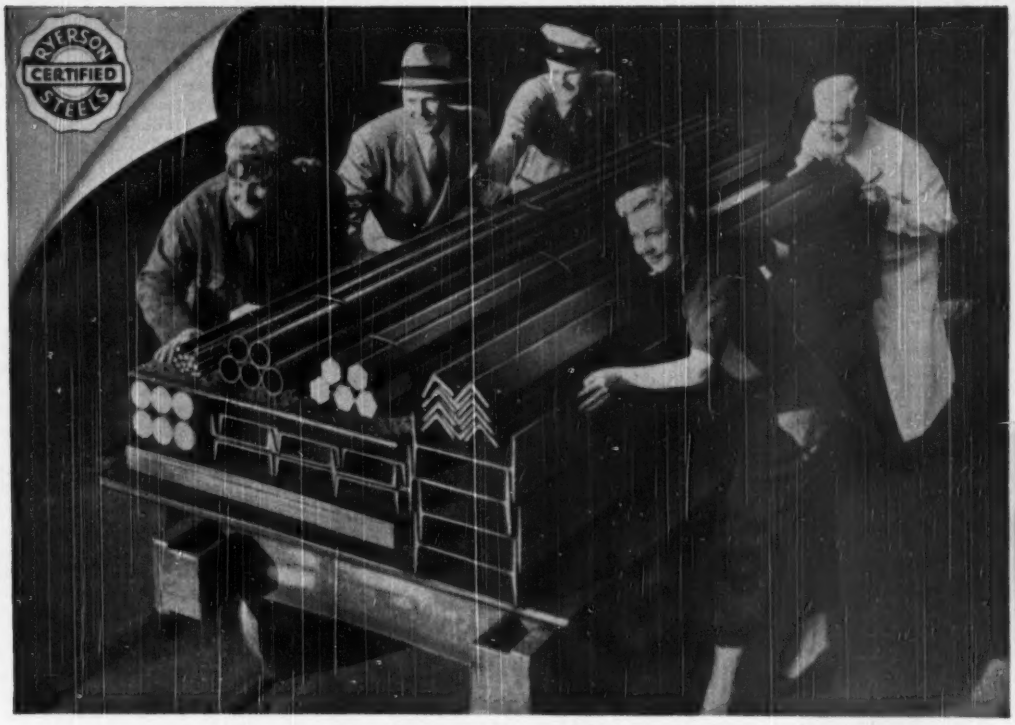
Givens joined GE at Schenectady in 1919 as a student engineer on the test course. Later he became a sales engineer for IGE and went to Mexico as an assistant engineer in 1921.

After a few years back at Schenectady he went to Argentina in 1927 as merchandise manager for General Electric Appliances, S. A., in Buenos Aires. Four years later he was made vice-president and general manager of the appliance sales subsidiary. Givens went to Brazil in 1932 and became vice-president and general sales manager of General Electric, S. A., in 1938.

Givens returned to IGE's New York office as assistant to the vice-president in charge of sales in the fall of 1946. He was named a commercial vice-president in 1947.

•

Henry R. Kruse, general commercial manager for Puget Sound Power & Light Co, has been appointed manager of the company's southern division at Olympia. He will take over the position left vacant by the recent death of Frank Walsh. Kruse has been with the company since 1923. He became sales manager of the eastern division at Wenatchee in 1930 and later moved to



Working Together for Faster Steel Service

Here's the team that swings into action the moment you contact a Ryerson plant. From the phone girl who receives your call to the driver who delivers your order it's a team of specialists who take pride in the job of getting steel to you quickly.

As soon as we take your order, duplicate copies are rushed to every person concerned and scheduling is completed simultaneously for all departments to prevent the slightest delay. In the warehouse, experienced steel men select your requirements from certified quality stocks. Carbon, alloy and stainless steels on hand in most every size, shape and finish make it easy for you to concentrate purchases—save time and develop lower costs. Then flame-cutters flash . . . friction saws roar . . . shears and punches crash. Your steel is prepared to exact specifications and rushed to the shipping floor according to schedule. A waiting truck speeds the steel to your door.

That's Ryerson steel service—a remarkable example of teamwork that enables us to ship steel in any form, to any place, in record time. Whenever you need high quality steel—need it fast—we urge you to call our nearest plant.

PRINCIPAL PRODUCTS

CARBON STEEL BARS—Hot rolled & cold finished

STRUCTURALS—Channels, angles, beams, etc.

PLATES—Sheared & U. M. Inland 4-Way Safety Plate

SHEETS—Hot & cold rolled, many types & coatings

TUBING—Seamless & welded, mechanical & boiler tubes

ALLOYS—Hot rolled, cold finished, heat treated

STAINLESS—Allegheny bars, plates, sheets, tubes, etc.

MACHINERY & TOOLS—For metal fabrication

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CINCINNATI • CLEVELAND
DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO

MOSINEE

"More than Paper"

If you have a fabricating or processing problem involving paper . . . if you require definite technical characteristics and, above all, *dependable uniformity*, it may be worthwhile for you and MOSINEE technicians to get together. MOSINEE is not interested so much in terms of volume production as in our ability to render helpful service to manufacturers in the field of electronics and in the electrical goods industry. Our "paperologists" are at your service for consultation. Please write Dept. EW.

MOSINEE PAPER MILLS COMPANY • MOSINEE, WIS.

Essential Paper Manufacturers

the northeastern division in Everett. In 1937 he became sales promotion manager for the company and five years later manager of the northern division at Bellingham. Later he headed the economic development and research department at Seattle, becoming general sales manager in 1945 and general commercial manager in 1947.

•

Engineering Posts Filled by Penn Transformer

Two new appointments have been announced by Pennsylvania Transformer Co. M. L. Manning has been named development engineer and Boris Volgovskoy, head of the substation and regulator department.

Manning's industrial experience includes motor and generator design work with Westinghouse Electric Corp, transformer design and research engineering with Westinghouse, and 4½ years as chief engineer of Kuhlman Electric Co. He also has been an associate professor of electrical engineering at Illinois Institute of Technology and at Cornell University, where he was in charge of the high voltage laboratory.

He is a fellow of the American Institute of Electrical Engineers and a member of CIGRE (International Conference on Large Electric High Tension Systems), the AIEE's transformer committee, and the American Society for Engineering Education and has taken an active part in standardization activities of National Electrical Manufacturers Association. For the past four years he has been working on the application of silicone insulation to transformers.

In his new post Volgovskoy will direct development and design of step voltage regulators, underload tap changers, and related equipment and furnishing of complete unit substations. Before joining Penn Transformer Volgovskoy was section engineer in charge of metal enclosed draw-out switchgear, switchboards, and mercury arc rectifier controls for the switchgear division of Allis-Chalmers Manufacturing Co. Earlier he had been with Cincinnati Gas & Electric Co.

•

Henry B. Oatley, vice-president and consulting engineer, Superheater Co, New York, has received an honorary doctor of engineering degree from Stevens Institute of Technology.

Ernest Sjorgen, president of Southern Nebraska Rural Public Power District, has been elected president of the Nebraska Association of Rural Public Power Districts. **R. C. Johnson,** of Mead, was elected vice-president. **M. G. Lindburg**. Polk, was reelected treasurer

Now!

Power transmission cable for carrying up to 33,000 volts. The "326" Monel Shielding is non-magnetic and highly corrosion resistant. Cables are supplied for 50,000 volts.

Tough Corrosion-resistant Non-magnetic

"326" MONEL-SHIELDED CABLE

Looking for a *really* tough, high voltage cable? One that will stand up under severely corrosive, abusive conditions . . . one with effective shielding that keeps corona-cutting and power loss at a minimum?

If you are . . . specify "326"® Monel Shielded Cable.

"326" Monel—a non-magnetic high nickel alloy—has many characteristics that make it an excellent shielding material. It is rustproof and highly resistant to most commonly-encountered corrosives. It is hard, tough, and unusually resistant to flexion cracking and stress fatigue.

Developed to combat high tension corona-cutting, "326" Monel Shielded Cable promises to provide a dependable answer to other troublesome conductor problems as well.

With its high corrosion-resistance and small diameter, high voltage cable with Monel shielding is particularly recommended for applications where space is limited and where maintenance would be costly . . . mines, tunnels, underground and submarine conduits, ships, oil well towers, chemical processing installations.

"326" Monel Shielded Cable is economical in price, too. It costs no more than you pay for other metal shielded cable . . . and for some types, even less.

A number of large cable manufacturers can now supply you with "326" Monel Shielded Cable. For quotations and delivery information, contact your regular cable supplier.

High voltage and corrosion did this!

Cable damage caused by corrosion of a metal shielding. Losses such as this can be reduced or eliminated entirely by specifying corrosion-resistant "326" Monel Shielded Cable.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

EMBLEM OF SERVICE
NICKEL INCO ALLOYS

MONEL® • "K"® MONEL • "R"® MONEL • "KR"® MONEL • NICKEL • "D"® NICKEL
LOW CARBON NICKEL • DURANICKEL® • PERMANICKEL® • INCONEL® • INCONEL "X"®

COBRA WOOD TREATMENT CORPORATION

Inspection Report

Report No. 1

Class _____ Line _____ Date _____

Date of Inspection	No. of Pole	Treatment	Diagram	CONDITION OF POLES	REMARKS
1949	227 L.	-		Severely rotted	To be replaced urgently
	227 R.	1		Severe external decay ground level to one ft below	Replace in 3 years
	228 L.	-		Completely rotten	To be replaced urgently
	228 R.	1		Severe external decay from ground level to 1ft below	Replace in 3 years
	229 L.	1		Decay at ground level and to a height of 1ft in one sector	Replace in 4 years
	229 R.			Severely rotted	To be replaced urgently

POLE *Testing*

Many users of Cobra Service say that the Cobra testing reports are a most valuable part of the service.

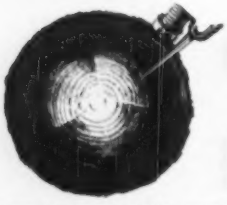
Imagine knowing exactly where you stand on every pole, on every line, at a cost of less than a dollar per pole. Estimate the savings effected when you replace useless poles before they come down. And what is it worth to be able to estimate exactly what your future pole line maintenance will be. One contract, no help from your crews, brings a report like the above *for each pole.*

POLE *Treatment*

The good poles can be saved by Cobra Treatment and their life extended twenty years for less than ten dollars per pole. Experience with Cobra Treatments of more than two million poles over a period of twenty years, with 80% repeat orders, proves the above statement.

ON ONE CONTRACT

The work is done by an experienced Cobra crew on contract. Ask for technical and experience data.



COBRA
WOOD-POLE
SERVICE

COBRA WOOD TREATMENT CORPORATION
124 EAST 40TH STREET • NEW YORK 16, N. Y.

and **Paul D. Marvin**, Lincoln, was renamed secretary. New executive committee members are Johnson; **Gregory Cripps**, Hays Springs; and **Wesley Schutz**, Columbus.

•

Banker Vice-President of Iowa Power & Light

A. Paul Thompson, cashier of the Central National Bank of Cleveland, has been elected vice-president and treasurer of Iowa Power & Light Co.

Thompson joined the bank as a mail clerk and was promoted through junior

A. PAUL THOMPSON

executive positions to cashier. He holds degrees in law and public accountancy and is a graduate of the school of banking of Rutgers University.

He is a member of the National Association of Bank Auditors and Comptrollers, National Association of Cost Accountants, and the American Statistical Association.

•

New Assignments

Edward B. Snyder has been appointed production manager of Bentley, Harris Manufacturing Co, Conshohocken, Pa. He formerly was technical director of the Conshohocken plant of Owens-Illinois Glass Co's Kimble Glass Division. . . . New manager of the Oconto Electric Cooperative, Oconto Falls, Wis., is **Laurence W. Garbrecht.** He succeeds **Earl G. Redman.** . . . **J. S. Morgan,** engineer-in-charge of sales for the switchgear and control sections of Allis-Chalmers' electrical department since 1947, has been named manager of the switchgear section. **Frederick C. Ludington,** who has managed the switchgear and control sections since 1946, will continue as manager of the control section. . . . **Clarence C. Davis** has been appointed resident engineer at the Army Corps of Engineers' Detroit Dam on the North Santiam River, suc-

ceeding **Lt Col John W. Miles,** who has been transferred to Okinawa. . . . **Victor Montegrim** has succeeded **W. D. Sinclair** as manager of the Pittsfield, Ill., power plant. Sinclair is retiring after 12 years in the post. . . . **Ernest B. Blease,** formerly supervising accountant for the Federal Power Commission, has joined H. Zinder and Associates, Washington, D. C., utility consultants, as an associate.

•

Eugene Logan, chief of the Federal Power Commission's division of projects cost for the past five years, has retired after 14 years with the Commission. Logan has been in the electric power field for 40 years, 16 of them in government service. Before joining FPC Logan was senior hydroelectric engineer with the United States Forest Service in San Francisco. Other positions he has held include those of assistant to the chief engineer of Washington Water Power Co, Spokane, and consulting engineer in Spokane and Seattle.

George C. Jelliffe has been appointed eastern district manager for Ilg Electric Ventilating Co, Chicago, Ill. He joined the company in 1946 as an assistant to the vice-president and general sales manager.

Matthew L. Devine and **Robert Kaye** have been admitted to partnership in Cresap, McCormick & Paget, management engineers of New York and Chicago. **Carl B. Hess** has been appointed director of development.

OBITUARY

Frederick O. Dolson

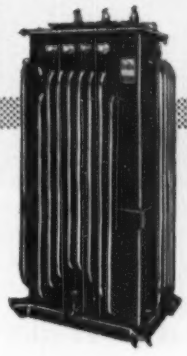
Frederick O. Dolson, 74, retired vice-president and general manager of California Electric Power Co, died recently at Riverside, Calif., after a long illness.

Dolson joined Southern Sierras Power Co, Calepco predecessor, in 1914 as inspector on the construction of the Imperial Valley line and later was put in charge of hydro plants on Bishop Creek. He also supervised the construction of the Rush Creek plant.

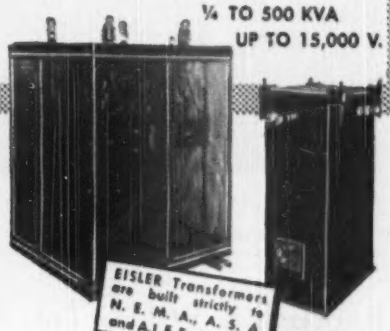
In 1918 he was transferred to Riverside as general superintendent for the associated companies, which included Nevada-California Power Co and Yuma Utilities Co, and four years later was elected vice-president. He was appointed assistant general manager in 1922 and general manager in 1929. In 1943 he was elected senior vice-president, and in 1946 he retired.

Dolson also was a past president of the Pacific Coast Electrical Association.

EISLER
TRANSFORMERS
STANDARD • SPECIAL
AIR • OIL • WATER-COOLED
for
POWER DISTRIBUTION • LIGHTING •
AUTO • ELECTRIC FURNACE •
HEATING • PHASE CHANGING •
WELDING • GENERAL PURPOSE



¼ TO 500 KVA
UP TO 15,000 V.



EISLER Transformers are built strictly to N. E. M. A., A. S. A. and A. I. E. E. standards.

In addition to the manufacture of standard transformers the Eisler organization is especially well adapted to design and build transformers to the customer's specifications when departure from standard construction is desired. Send in your specification for quotations.

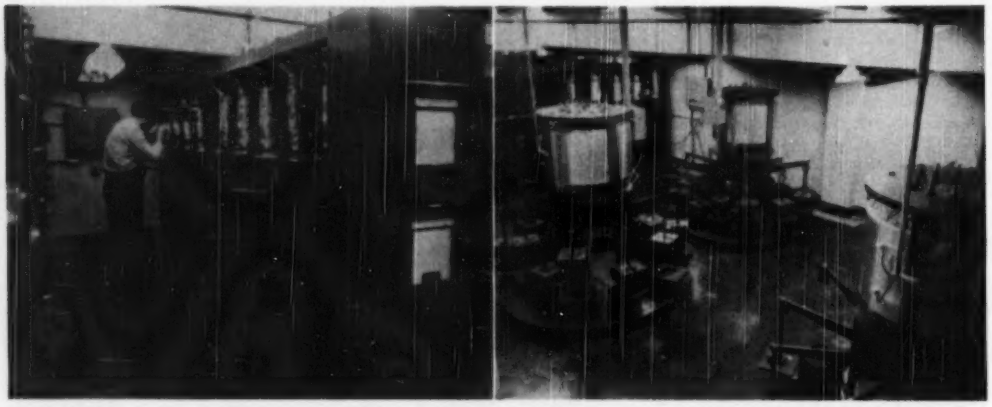
SEND FOR NEW CATALOG TR-50

EISLER
RESISTANCE WELDERS
SPOT • BUTT • GUN • SEAM

A complete line of Resistance Welders from ½ to 300 KVA for all types of welding.

CHAS. EISLER, Pres.
EISLER ENGINEERING CO. INC.
769 SOUTH 13th ST. NEWARK 3, N. J., U. S. A.

MANUFACTURERS and MARKETS



APPARATUS for testing creep and stress-rupture properties of carbon steel, alloy steel, and other metals has been installed at Alliance, Ohio, laboratory of Babcock & Wilcox Co. Creep-testing equipment, shown in front view at left, was designed at Massachusetts Institute of Technology by Prof F. H. Norton and Babcock & Wilcox engineers. Twelve-station units for studying stress rupture, right, were built at the Alliance laboratory. Results of the studies will be of value to manufacturers of boilers and generating equipment.

Babcock & Wilcox Lab Makes Studies on Creep, Stress Rupture of Metals

Potentially useful to manufacturers of boilers and turbines, studies of creep and stress rupture of metals are under way at Babcock & Wilcox Co's Alliance, Ohio, research and development laboratory.

Creep, the permanent deformation that occurs with time in metals subjected to stress at high temperatures, and stress rupture, which is creep continued to actual failure, are major problems of makers of equipment that must operate under high temperature and stress. Such data play a part in making rolled-in joints, super-heater tubes, headers, baffles, fittings, and turbine wheel forgings and blades.

Babcock & Wilcox now is carrying on at Alliance tests begun at Massachusetts Institute of Technology in 1926 after establishment of a joint B&W-B&W Tube Co fellowship. The apparatus used at MIT, designed by Prof F. H. Norton and B&W engineers, has been moved to the company's laboratory. This equipment included 20 stations designed for creep tests but also usable for stress-rupture tests.

Babcock & Wilcox has built four 12-station units for stress-rupture study and has bought 16 Baldwin-Southwark, single-station, lever-arm, creep-testing machines suitable for both tests.

Creep is measured by placing test specimens in especially designed furnaces and keeping them under a predetermined stress and at constant temperature for 10,000 hours or more. Much greater stresses are applied in stress-rupture tests, which may last just as long. A series of test bars is subjected to static stresses of various magnitudes at a selected temperature, and the time for fracture is determined.

B&W's equipment permits measurement of a change of less than 10 microinches in the length of a test bar. Temperature can be controlled within 1 deg F up to 1,550 deg F in creep tests and within 3 deg F up to 1,500 deg F in stress-rupture tests.

With the Baldwin-Southwark machines a maximum temperature of 1,800 deg F, controlled within two degrees, is possible. Accuracy of the reading is approximately 50 parts in a million.

The laboratory's capacity now makes it possible to perform 36 creep tests and 48 stress-rupture tests, or 84 stress-rupture tests, at the same time.

MANUFACTURING BRIEFS

General Electric Co expects to bill as heavy a shipment of goods in the first quarter of 1950 as in the corresponding quarter last year, Philip D. Reed, chairman, told a press conference. First quarter 1949 billings totaled $389 million. Bookings of lighter goods such as radio sets, lamps, ranges, and television sets are running well, and operations are almost at capacity in these lines. GE now is turning out 10,000 television sets a week, its highest rate and around four times the level of a year ago.

A new sales office has been opened by Cutler-Hammer, Inc, Milwaukee, at 410 W First St, Dayton, Ohio. P. L. Erickson manages the office as a branch of the firm's Cincinnati district office.

January television set output exceeded all months of last year except November, the Radio Manufacturers Association reports. Members of the association turned out 335,588 receivers in January, and average weekly production was 15% above the figure for December.

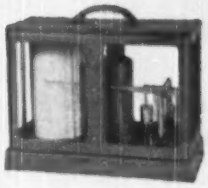
Mahoning Valley Steel Co, Niles, Ohio, is starting a new department to experiment with the manufacture of electric

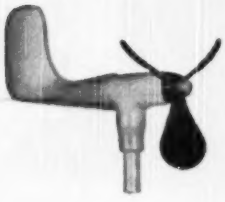
Bendix-Friez INSTRUMENTS

for ANY Weather Condition!

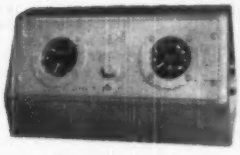
THE AEROVANE® RECORDER —Dual recorder for wind speed and wind direction — ideal instrument for meteorological stations — particularly well adapted to the requirements of industry in general.

MICROBAROGRAPH — An exceptionally precise recording Barometer. Producing an expanded graph of atmospheric pressure, registers each minute change in atmospheric pressure (within 0.01 inch mercury).

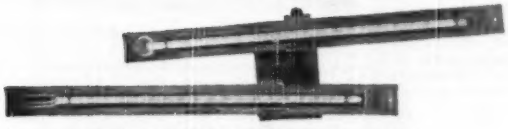




THE AEROVANE® TRANSMITTER — Combines wind speed and direction components in one unit. It consists of a three-bladed molded rotor to measure wind speed, and a streamlined vane for wind direction.

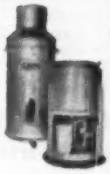


THE AEROVANE® INDICATOR —Indicator Panel supports the two 3¼" indirectly illuminated indicator dials and the indicator mechanisms — a rheostat knob is provided on the face of the panel for regulating the dial illumination.



MAXIMUM-MINIMUM THERMOMETERS are in service at all meteorological and climatological stations to collect basic climatic data. Maximum and Minimum Thermometers provide an easy method for determining extremes of temperature over any desired period.

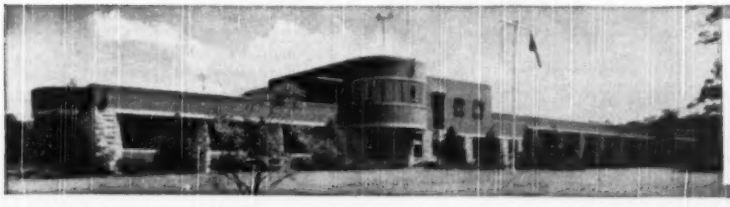
UNIVERSAL RECORDING RAIN GAGE — The universal Recording Rain and Snow Gage is designed and constructed to assure durability and long life under severe weather conditions. All forms of precipitation—rain, hail, sleet and snow—may be measured.



Whatever your needs for weather data, and wherever you need to collect them, BENDIX-FRIEZ makes the proper instrument for the purpose. Manufacturers of the world's finest meteorological instruments and principal supplier to the United States Weather Bureau for over 73 years. Prices and literature on request. ®REG. U. S. PAT. OFF.

WRITE: *FRIEZ INSTRUMENT DIVISION of*
1376 Taylor Avenue • Baltimore 4, Maryland
Export Sales: Bendix International Division, 72 Fifth Avenue, New York 11, N. Y.

Bendix AVIATION CORPORATION



Source of the World's Finest Weather Instruments

WIRING NEWS

A PERIODICAL DIGEST OF WIRING IDEAS FROM THE GENERAL ELECTRIC CONSTRUCTION MATERIALS DEPARTMENT

Free Chart Speeds Box Selection

The chore of selecting the proper switch or outlet box for any job is now made easy and sure by a new, large-size chart, recently published by the General Electric Construction Materials Department.

Illustrating each type of switch and outlet box—giving all box dimensions—listing number of conductors permitted for each wire size—this chart helps you make your choice at a glance. In addition, National Electrical Code requirements are listed on the chart for easy reference.

If you're working on installations, you'll want one of these handy charts hanging on your wall. If you're selling, you'll want several for your customers. For free copies of the *Box Buyers' Guide*, check box (A) in the coupon, and note the number of charts you need.

Silent Switch Gives Extra-duty Service

More than a million ON-OFF cycles! That's the amazing service record of the GE 3008 mercury switch.

Your industrial customers will welcome this news of long service life. Builders will be interested in the extra "sell" that mercury switches offer. For further details on G-E mercury switches, check box (B) in the coupon.

Two Time-savers Added To Remote Control Line

General Electric has recently announced the addition of two new extra-convenience items to its remote control wiring system —for extra convenience in use, a new nine-position master selector switch—for installation savings, a new utility unit.

The new master selector switch, GE 3652, puts full ON-OFF control of nine circuits on one standard-size flush plate. A rotary switch is used to select circuits. A standard remote control switch opens or closes the selected circuit. All circuits can be instantly opened or closed by depressing the remote control switch and sweeping the rotary selector through all nine positions.

New Utility Unit

The new G-E remote control utility unit, GE 3614, containing a remote control relay and transformer in one die-cast aluminum housing, adds extra speed to remote control installations. For indoor or outdoor use, this unit requires only three simple connections: incoming and outgoing 125-volt lines and lead wires for remote control switches. Fixtures can be mounted directly on the unit or at a distance from it according to installation requirements.

If you have not yet investigated the General Electric remote-control wiring system, get full details from your local G-E distributor or from your local General Electric office. For a bulletin on the G-E remote-control wiring system and fact sheets on the new rotary switch and utility unit, check (C) in the coupon.

Existing Raceways Can Take Extra Loads

Industrial customers who are contemplating increased power loads will appreciate a tip on G-E Deltabeston® AVA cables.

In many cases, these cables can help increase load capacity up to 49% with no additional raceways. This can add up to sizeable savings for your customers. For information on AVA cables check (F) in the coupon.

Now, Get the Answers On Gas-filled Cable

Now, your questions on the use of gas-filled cable are answered in a new fact-packed booklet.

In 12 pages of text and illustrations, this booklet explains the savings and extra values that General Electric gas-filled cable offers. The advantages of self-supervision, smaller diameter, and greater uniformity of various types are fully discussed.

For your free copy of the new booklet, *G-E Gas-filled Cable*, check box (D).

Cuts Trimming Problems In Residential Areas

When you're planning new distribution through residential areas, don't overlook the two big advantages of General Electric Super Coronol® aerial cable — improved appearance and substantial economies in trimming costs.

Because these cables are fully insulated, no crossarms are required. Tree trimming can be reduced to a minimum. In some cases, this means that trimming can actually be eliminated for long periods. Even in three-phase circuits, Super Coronol Aerial cables have the compactness and strength required to hold your trimming costs down.

Aerial cable can be supplied to you preassembled—with cable and messenger assembled at the plant for quick installation —or unassembled—for assembly of cable and messenger in the field. Single- and multiple-conductor cables are available.

Your local General Electric district office will gladly give you detailed information on aerial cables. For a handy booklet check box (E) in the coupon.

Section K5-327
Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut

Please send me:

- A ☐ *Box Buyers' Guide*
- B ☐ Information on Mercury Switches
- C ☐ *Remote-Control Booklet* and fact sheets on utility unit and rotary selector switch
- D ☐ *G-E Gas-filled Cables*
- E ☐ *Aerial Cables*
- F ☐ *AVA Cables*

Name ..... Title .....

Company .....

Address .....

City ..... Zone ..... State .....

Hint for power salesmen

Practical tip for installation, maintenance, and operation personnel

GENERAL ELECTRIC

metallic tubing by induction welding. A tube mill and plating line have been purchased for the $100,000 installation. The firm, a subsidiary of General Electric Co, will produce a light wall pipe or tube for encasing electric wires in factory and commercial buildings.

•

Christoffel Found Guilty in Second Perjury Trial

Harold R. Christoffel, former president of Local 248 of the CIO United Automobile Workers at Allis-Chalmers Manufacturing Co, is awaiting sentence following his conviction in Washington on five counts of perjury. The conviction will be appealed.

Christoffel was convicted a second time of perjury when he denied Communist affiliations before the House Labor Committee on March 1, 1947. The first conviction was set aside by the Supreme Court because the prosecution had not shown that a majority of the House committee was present at the time of the alleged perjury. The prosecution proved this point at the second trial.

Christoffel faces a maximum penalty of two to ten years' imprisonment on each count.

SALES ASSIGNMENTS

COMPANY STAFFS

Westinghouse Electric Corp, Pittsburgh, has named Frank E. Bodine assistant central station manager for the Pacific Coast district, with headquarters in San Francisco. He has been Pacific Coast manager of maintenance sales.

Fairbanks, Morse & Co, Chicago, has made two changes in branch house management. J. C. Elmburg, manager of the Atlanta branch, has been transferred to Portland, Ore., where he will succeed Howard Oxsen as branch manager. Oxsen is returning to San Francisco to be manager of diesel engine sales in that area. George A. Hawkins, manager of the company's sub-branch at Minneapolis, has been appointed Atlanta branch manager.

Sylvania Electric Products, Inc, New York, has named James F. Davis district sales manager of the New Jersey area. He formerly was a territorial salesman in the New York City lighting division.

REPRESENTATIVES

Hobart Brothers Co, Troy, Ohio, has named White Welding Supply Co, St. Louis, to represent it exclusively in the sale of Hobart arc welders, electrodes, and accessories for metropolitan St. Louis and the surrounding Missouri and Illinois counties.

Dampney Co, Boston, has appointed R. E. Mundy Co, 1520 Cleveland, S. W., Roanoke, Va., as sales representative in central Virginia and adjacent territory in West Virginia.

PUBLIC RELATIONS are PLEASANT RELATIONS
when BARTLETT clears your lines
EVERYBODY likes the Bartlett Tree Man . . . friendly, cooperative, and obviously skilled at his job; your customers will like the neatness and efficiency of Bartlett work, performed with a minimum of disturbance to their property and everyday life. Bartlett on the job is your assurance of more friendly public relations.
YOU receive plus value when you retain Bartlett for line clearance; contact our local office in your community or write direct to the home office; our nearest representative will call promptly.
BARTLETT SERVICE MEANS
• CLOSE SUPERVISION
• TRAINED MEN
• BEST EQUIPMENT
• CAREFUL WORK
• PROMPT SERVICE
• ECONOMY
• RESPONSIBILITY
BARTLETT
TREE EXPERTS
The Bartlett Way
HOME OFFICE: RESEARCH LABORATORIES & EXPERIMENTAL GROUNDS, STAMFORD, CONN.
LOCAL OFFICES: Bellows, Windsor, Vt.; Milford, Peterboro, Rochester, N. H.; Cambridge, Framingham, Manchester, Osterville, Pittsfield, Mass.; Providence, R. I.; Danbury, Hartford, New Canaan, New Haven, Stamford, Westport, Conn.; Islip, Kingston, Monroe, Middletown, New York, Peekskill, Southampton, Syracuse, Westbury, White Plains, N. Y.; Bernardsville, Morristown, Orange, N. J.; Chambersburg, Paoli, Philadelphia (Cynwyd), York, Pa.; Wilmington, Del.; Bethesda, Easton, Towson, Md.; Ashland, Ky.; Lancaster, Portsmouth, Ohio; Charlottesville, Lynchburg, Roanoke, Va.; Bluefield, Charleston, Huntington, W. Va.; Kingsport, Tenn.

Why take a wood preservative to LUNCH?
Gone is the day when workmen handling treated wood —poles or lumber—couldn't avoid getting sticky and dirty. Today the clean Penta Preservative treatment means no messiness to stick to clothes and maybe skin. That's the big reason workmen are asking for Penta protection of the wood they have to handle. Penta Preservative just doesn't leave any stickiness.
And for protection value, you can't beat Penta Preservative. No other commercially used preservative, by any kind of test, has ever proved superior to Penta Preservative in withstanding insects and decay. Most important, protection with Penta is sure. The chemical make-up of pentachlorophenol cannot vary; the Penta of today cannot fail to give the same outstanding protection as the Penta of years ago.
Why not give your workmen the extra benefit that Penta Preservative provides? It helps labor relations and costs no more than other standard preservative treatments. We'll be glad to give you full information on Penta Preservative. Just ask for it.
CHAPMAN CHEMICAL COMPANY
757 Dermon Building
Memphis 3, Tenn.
TRADE
CHAPMAN
MARK
IT'S CERTAIN • IT'S CLEAN
PENTA
PRESERVATIVE
IT'S CERTAIN • IT'S CLEAN

NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Arkansas—C. & L. Rural Electric Cooperative, Star City, 303 mi. rural distr. lines and other imprvs., Proj. ARK-21, Lincoln Co., **$525,000**. Chanaberry Eng. Co., Coleman Bldg., Louisville, Ky., consult. engr.

Arkansas—Southwestern Power Admin., Tulsa, Okla., 46 mi. 154 kv transmission line from Norfolk to Pocohantas, Contr. SPA-291, **$140,000**. Plans deposit $15.

Colorado—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, furnishing, del. f.o.b. cars Brush, out-door type synchronous condenser with control equip. for Beaver Creek substation Colorado-Big Thompson Proj., Spec. 2929. L. N. McClellan, ch. engr.

Fla., Jacksonville—City. City Hall installing Georgia Street Switching Station, part of Power Plant 2, Adv. 2-25-43. Plans deposit $2. Reynolds, Smith & Hills, 227 Park St., Zone 1, engrs.

Ill., Belleville—Belleville Daily News Democrat, Robert Kern, publisher, radio station studios, transmitter, etc., incl. 1 story, brick, 5,000 sq. ft. structure, transmitter, steel tower for AM radio station, air-conditioning. Russell, Crowell, Mullgardt & Schwarz, 1620 Chemical Bldg., 721 Olive St., St. Louis 1, Mo., archts.

Ill., Urbana—University of Illinois, Urbana, structural steel power plant, **$2,000,000**. Sargent & Lundy, 140 S. Dearborn St., Chicago, Zone 3, engrs.

Kan., Kansas City—Bd. Pub. Utilities, power plant changes, imprvs. Burns & McDonnell, 95 and Troost Sts., Kansas City, Mo., engrs.

Kentucky—Fleming Mason Rural Electric Co-operative, Flemingsburg, approx. 500 mi. rural distr. lines, 2 electric sub-stations, Bath, Carter, Greenup, Bracken, Mason, Lewis, Elliott, Powell, Robertson, and Rowan counties, **$3,000,000**. Patterson & Dewar, 208 Rutland Bldg., Decatur, Ga., consult. engrs.

Kentucky—U. S. Eng., 302 U. S. Courthouse, P. O. Box 1070, Nashville 1, Tenn., furnishing f.o.b. railroad cars Somerset, accessory electrical equipment for Wolf Creek Hydroelectric Power Plant, Cumberland River, Russell Co., CIVENG-46-958-50-37.

La., Monroe—City. City Hall, warehouse and office for Electrical, Water & Sewer Dpts., of City, Roy Johns, c/o Ford, Bacon & Davis Constr. Corp., 805 S. Grand St., archt.

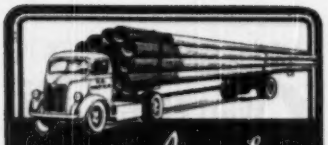
Michigan—Consumers Power Co., Jackson, transmission lines, imprvs., Adrian, Tecumseh, Manchester, Montgomery, Camden, Pleasant Lake, Erie, and Dunbar; sub-stations, LaSalle, Onsted, North Adams, Pittsford, Sylvan and Concord; 60,000 kw generator at B. C. Cobb Plant, Muskegon; 46 mi. gas mains leading to company's Michigan storage field, near Cadillac.

Nebraska—Consumers Public Power Dist., 1452 25 Ave., Columbus, furnish material, equip., labor, supervision, transportation, and misc. expense to construct and reconstruct rural distr. lines from Loup River Public Power Dist. sub-station south and east of Norfolk, west to Oakdale, via Battle Creek, Meadow Grove and Tilden. Plans deposit $15.

N. M., Las Cruces—U. S. Eng., Box 1538, Albuquerque, Lot 1, electrical distr. sys., $50,000; Lot 2, underground utilities, gas, sewers, water, $90,000; Lot 3, earthwork, paving, $80,000, Serial No. Eng-29-605-50-34. Plans deposit $25.

Ohio—U. S. Eng., Madison Ave. and 8 St. West Huntington 18, W. Va., permanent switchboard and control equipment for Delaware Dam, Delaware Reservoir Proj., Olentangy River, Serial No. CIVENG-46-022-50-79. Extended date.

Ohio—Columbus & Southern Ohio Electric Co., 215 N. Front St., distr. system expansion, **$4,575,000**, incl. new sub-station in eastern part of Columbus, **$150,000**; sub-station near Athens, **$80,000**; sub-station at Camp Sherman near Chillicothe, **$50,000**; Canal, Rich and Gay St. sub-



Haley's

CEDAR POLES
FIR CROSS ARMS

Quick Truck Shipments from our Ohio yard

●

Also yards at Minneapolis and Haley, Idaho

R. G. HALEY & CO., Inc.
SPITZER BLDG.
TOLEDO 4, OHIO

(Advertisement)

NO HESITATION . . .

. . . Approving Buying Information

Mr. F. K. Steel, owner of The F. K. Steel Company, a firm of Electrical Engineers at Great Falls, Montana does not hesitate to express his approval of McGRAW-HILL'S PRE-FILED ELECTRICAL CATALOGS as a decided asset in the operation of his business. He recently expressed his feelings about this handy-but-inclusive volume of pre-filed Buying Information as follows:

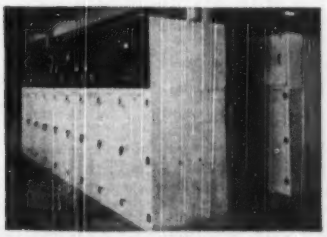
"We can say without hesitation that reference (to the Catalogs) is quite frequent and that the Catalogs represent a decided asset to our operations."

If PRE-FILED ELECTRICAL CATALOGS is not available for buying reference at your plant, write to McGRAW-HILL CATALOG SERVICE, 330 West 42nd Street, New York 18, N. Y. There is no charge to qualified users.

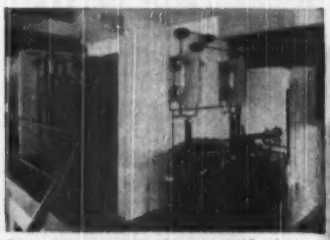
WHY STATION EXPANSION PROGRESSES FASTER . . . COSTS LESS

. . . with Trancell Materials

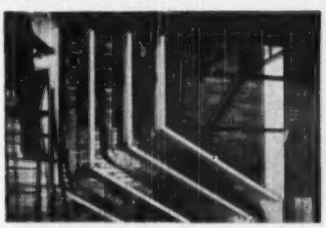
If you're planning to expand your power stations or substation facilities, do what many leading power companies have already done . . . make your station change-overs with Johns-Manville Trancell Materials.



They're safe—fireproof . . . have low heat conductivity . . . adequately isolate high-voltage apparatus.



They're neat—make clean, flush-type housings, panels, doors, and partitions.



They're handy—easily cut and drilled on the job, or furnished cut to your specifications.

They're durable—rotproof and rustproof . . . will last for years. Require a minimum of maintenance.

They're economical—light, easy to handle and assemble. Have excellent re-use value.

—for all high voltage power equipment enclosures—Johns-Manville Trancell Materials are made in many sizes and types. Recommended for transformer and switch gear housings and partitions; bus bar enclosures and other services. For further information write to Johns-Manville, Box 290, New York 16, New York.

JM

Johns-Manville
TRANCELL
an asbestos product for housing electrical equipment

EVERSTICK ANCHORS...

First Choice for

PERMANENCE
HOLDING POWER
LONG LIFE
SAFETY

They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install — made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way and cone types. Write for facts.

Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of "The Anchor of Merit"
FAIRFIELD, IOWA

stations addns., $100,000; installing voltage regulating equip., $400,000; installing equip. in sub-stations throughout 21-county area, $630,000; constr. 21 mi. rural distr. lines near here and 210 mi. rural territories of southern area, $330,000; rebuild distr. system in Grove City, $130,000; imprv. underground distr. sys. in downtown Columbus, $130,000; street lighting imprvs. principally in Chillicothe and McArthur, $115,000; purchase and install distr. transformers, $480,000; purchase and install meters, install service wires to new customers, $618,000; new service bldgs., in southern Ohio and in Columbus (four new bldgs.), $600,000; and minor addns. alterations to other company structures, $400,000; overhead transmission line, 138,000 volt from E. M. Poston generating plant in Athens Co., to Chillicothe to Circleville and to Marion Rd. in South Columbus, $2,035,000; transmission lines connecting the new sub-stations to be built in Columbus, $600,000; imprv. other transmission circuit of lower voltage at various points in Central and Southern Ohio, $455,000; new 138,000 volt sub-stations in or near Columbus, $1,300,000; 138,000 volt sub-station in Chillicothe, $465,000; finish erection of high voltage sub-station in Circleville, $135,000; addns. to transmission sub-stations in and near Columbus and in Athens, Ross and Highlands Counties, $680,000.

Okla., Blackwell—City, Blackwell, building alterations, power piping, power wiring, and switchboards for Blackwell power plant. $275,000. Black & Veatch, 4706 Broadway, Kansas City, Mo., engrs.

Tex., Longview—Southwestern Gas & Electric Co., Longview, 8 mi. 132,000 volt transmission line between power plant and Whitney sub-station, $340,000; addnl. electric transmission and distr. lines, eastward sects. from Longview, $750,000.

Tex., Paris—Lamar County Electric Cooperative Assn., Paris, power plant, $140,000. Freese & Nichols, 407 Dancliger Bldg., Ft. Worth, consult. engrs.

Virginia—U. S. Eng., foot of Front St., Norfolk, generator main leads and cubicles, Buggs Island Powerhouse, Roanoke River, Mecklenburg Co. Inv. Serial No. CIVENG-44-110-50-56.

Washington—Bureau Reclamation, Dpt. Interior, Coulee Dam, right switchyard exten. for Grand Coulee Power Plant at Grand Coulee Dam, Columbia Basin Proj., Spec. 2932. L. N. McClellan, Bldg. 1-A, Denver Federal Center, Denver, Colo., ch. engr.

Low Bidders & Contracts Awarded

Ia., Corning—City, City Hall, electric plant imprvs., to R. W. Hughes Co., Sunderland Bldg., Omaha, Neb., $117,249. Bids 2/13.

Okla., Fairfax—K.A.M.O. Electric Cooperative, Fairfax, 1,000 kw. engine generator set for power plant to Nordberg Mfg. Co., Chase Ave., Milwaukee. Wire, $92,475. Est. $100,000. Awarded 2/1. W. R. Holway, 302 E. 18 St., Tulsa, engr.

Pa., Pittsburgh—H. J. Hein Co., 1062 Progress St., power plant alterations, to George A. Fuller Co., 597 Madison Ave., New York, N. Y. Approx. $200,000. Bids 11/30.

Washington—Bonneville Power Admin., Box 3537, Portland 8, Ore., constr. 59.8 mi. Olympia-Covington 230 kv. transmission line, Thurston, Pierce and King Counties to Smith Bros., Vancouver. $444,444. Bids 2/15, awarded 2/24.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

N. M., Los Alamos—U. S. Atomic Energy Comm., Los Alamos, 2 story, bsmnt. monolithic concrete, structural steel roof framing, laboratory, concrete slab and pier fdn., air-conditioning. Proj. D. TA-3. $10,000,000-$12,000,000.

Low Bidders & Contracts Awarded

Ill., Evanston—Cadillac Motor Car Div., General Motors Corp., 1938 N. Ridge St., sales and service, to Ragnar Benson Inc., 4744 W. Rise St., Chicago, Zone $31,300,000. Bids 2/9, awarded 2/23.

Pa., Pittsburgh—Kenilworth, Inc., 5821 Walnut St., 100x180 ft., brick on block, steel apartment, to Behrman & Passell, 5821 Walnut St. Approx. $1,300,000. Tennyson & Van Wart, 646 Washington Rd., Zone 16, archts.

For Beautiful
Well Lighted STREETS

KERRIGAN STANDARDS

More than meet the Tests—

Write for

Your FREE copy now!

(on your letterhead, please).

Kerrigan Weldforged Lighting Standards are designed and engineered to conform to I.E.S. Street Lighting Codes, and meet the highest engineering standards for highway and street lighting. Whatever special lighting problems you may have, KERRIGAN can help you solve them. Check the Kerrigan specification list below to see what Kerrigan Weldforged Standards offer you, then write for our Lighting Standards booklet AIA 31F for detailed specifications and catalog information.

- √ 20, 25, 30 foot shafts to conform to I.E.S. recommendations; 4, 6, 8, 10, 12 and 15 foot mast arms to conform to I.E.S. recommendations.
- √ Continuous Tapered Octagon shafts from open hearth steel.
- √ Heavy Steel construction for maximum strength.
- √ Detachable mast arms, brackets, and transformer bases for easy installation and maintenance.
- √ Ornamental scroll braces for beauty and strength.
- √ Mechanically primed at the factory with red oxide, inside and out, for longer life. Finish coat can be easily applied after standards are in place.
- √ Special designs to meet ANY and ALL Special Requirements.

Consult the
KERRIGAN ENGINEERING DEPT.
concerning your street lighting problems

— Write —

KERRIGAN IRON WORKS, Inc.
General Sales Office:
274 MADISON AVENUE, N. Y. C.

CATALOGS • BULLETINS

● TRANSFORMERS: Descriptions and specifications of transformers for operating luminous tubing are presented in Bulletin 491-55. Jefferson Electric Co, Bellwood, Ill.

● WIRE MARKER: Advantages, uses, cost, and variety of E-Z code wire markers are presented in Bulletin 349. Western Lithograph Co, 609 E. Second St, Los Angeles, 54, Cal.

● CABLE SYSTEMS: Typical electric distribution system layouts with discussions of the applications of various cable sectionalizing devices are presented in Bulletin H49, G & W Electric Specialty Co, 7780 Dante Ave, Chicago 19, Ill.

● PHASE SHIFTERS, ETC.: Applications and descriptions of phase shifters appear in Catalog 1, Section 2E. Section 8F of Catalog 1 provides information on binding posts, terminal lugs, potential switches, etc. Section 1E offers information on portable phantom loads for prolonged duty cycles and demand meter testing. The States Co, 19 New Park Ave, Hartford 6, Conn.

● TELEMETERING: Latest telemetering equipment for electric power distribution and industrial applications is described in a 20-page bulletin, GEA-5233. General Electric Co, Schenectady 5, N. Y.

● M-G SETS: Catalog Sheet Form 549-MG contains information on converters, motor-generators and high frequency generators. Kato Engineering Co, 1415 First Ave, Mankato, Minn.

● TURBINES: Catalog 4200 shows the basic types of De Laval turbines for different operating conditions and applications up to 20,000 hp. De Laval Steam Turbine Co, Trenton 2, N. J.

● STARTER: Features of Type RMC manually operated reduced voltage autotransformer motor starters are described in Bulletin 14B7215. Allis-Chalmers, Milwaukee 1, Wis.

● SPLICING SLEEVES: Information on splicing sleeves, dead-ends and other related equipment is contained in Catalog 36. The National Telephone Supply Co, 5100 Superior Ave, Cleveland 3, Ohio.

● VARIACS: Many different types of Variac up to 24.7 kva are covered in Form 424-K. General Radio Co, Cambridge 39, Mass.

● LIGHTING: A 40-page bulletin lists prices and lighting data on the Sky-Glo luminous louvered systems and many types of industrial and outdoor lighting. Van Auken, Ragland and Stevens, 326 W. Madison St, Chicago 6, Ill.

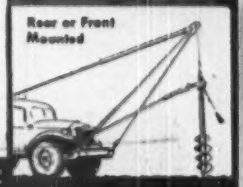
● FIXTURES: Over 250 domestic lighting fixture designs, illustrations in color, appear in the 1949-50 Style Book. Lightolier, Inc, 346 Claremont Ave, Jersey City 5, N. J.

Operates ON ANY DERRICK TRUCK

- Adjustable for clean holes to 10 ft. deep
- Interchangeable augers 8" to 20" diameter
- Drills a straight hole from any truck position
- Easy to use—easy to transport

TEL-E-LECT POLE HOLE DIGGER

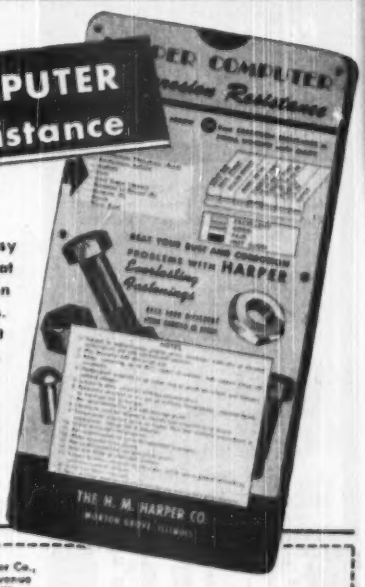
WITH the Tel-E-Lect Pole Hole Digger, you use the same truck and crew that sets the pole. You can drill a hole any place that you can spot the pole derrick. A single bolt attaches the digger to the truck; it works suspended from the derrick. Powered by the truck motor through a power take-off shaft, Tel-E-Lect is raised and lowered by the winch line. Fits the budget of even the smallest utility, and quickly pays for itself. *Ask for circular.*



TEL-E-LECT PRODUCTS, Inc.
10003 MINNETONKA BOULEVARD, MINNEAPOLIS 16, MINNESOTA

SEND FOR YOURS TODAY!

HARPER COMPUTER of corrosion resistance



Gives you a quick, easy method of determining what metal alloys to use in connection with 143 different corrosive agents. Ideal for metallurgists, product designers, engineers, chemists, purchasing agents. Sized to fit your pocket. Developed by The H. M. Harper Co., America's leading specialist in non-ferrous and stainless steel fastenings.

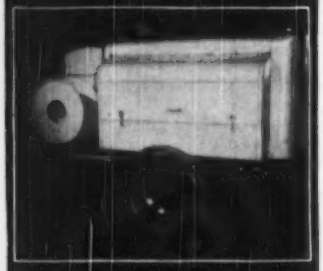
FREE
Mail Coupon Today

The H. M. Harper Co.,
8205 Lehigh Avenue
Morton Grove, Illinois

Please rush my free copy of the Harper Computer of Corrosion Resistance.

Name .....
Company .....
Address .....
City ..... State .....

Compressor Users:
Get the facts
about the new
SMITH
105-P
Compressor



Packs a wallop
FOR POWER!
Costs less to Operate!

Powered with the new Chrysler 6cd. I.C. Industrial Engine with 277 Cubic inch displacement. Delivers 105 cubic feet per minute. Sodium cooled valves and Stellite valve seats in engine. Stainless steel disc type valves and Manganese Bronze seats in compressor. Smooth even flow of air. Self starter, battery ignition, voltage regulator, large radiator capacity with thermostat for quick warm-up. Heavy duty with light weight (2100 lbs.)

Write for literature and prices.

Also write for information on
The New SMITH
MODEL 70-P COMPRESSOR

SMITH
Air Compressors
Gordon Smith & Co. Bowling Green, Ky.
482 COLLEGE STREET

BOOK REVIEWS

The Electrician Annual Tables of Electricity Undertakings of the World, 1949-50. **Published by Benn Brothers, Ltd, 154 Fleet St, London E.C. 4, 454 pages. Price 2/6.**

This directory carries information about power enterprises, offices, officers, system characteristics, peak, customers, output and generating capacities. The first half gives such information for Great Britain and Northern Ireland and ensuing quarters cover the British Commonwealth. Section C lists foreign undertakings with the data for the larger communities; 9 for France, 6 for Germany, 7 for Mexico, 20 for U.S.A., etc. Advertising keeps the cost quite reasonable for so comprehensive and useful a reference work.

Handbook of Rigging. **By W. E. Rossnagel. Published by McGraw-Hill Book Co, Inc, New York 18. 321 pages, illustrated. Price $4.75.**

Rigging for handling and hoisting equipment and materials can be a much safer operation if the data and advice in this book are appreciated and observed. Out of his Consolidated Edison experience the author has compiled the information about ropes, cables, hooks, chains, slings, knots (no less than 108), timber, etc, to set up the strengths and safety factors needed to contrive scaffolds and repair smokestacks. Ladders, cranes, hoists, derricks, chain hoists follow. Closing chapters deal with accident prevention, first aid, and a list of pertinent codes, laws and standards.

The Protection of Transmission Systems Against Lightning. **By W. W. Lewis. Published by John Wiley & Sons, New York 16. 418 pages, illustrated. Price $8.00.**

Professor Lewis compiles here what he knows through direct contact because he was one of the major figures in the long, intensive quest to subdue lightning. He culls the essence from the literature which he and his collaborators and contemporaries produced and, other than McEachron's recent encyclopedia article and the AIEE compilation, offers the first text-book-size treatment of lightning magnitudes, lightning protection and lightning-proof design. Naturally that makes the book an authoritative and impartial one that transmission, distribution, substation and protection engineers will surely want for facile and convenient reference.

Giant Brains. **By E. C. Berkeley. Published by John Wiley & Sons, New York 16. 270 pages, illustrated. Price $4.00.**

In no sense a "Frankenstein" or "RUR" book, this does, however, project the day when many of man's think-out problems will be solved for him electrically or mechanically. The author's complete familiarity with the basic principles of the various computers enables him to put in ABC language the rudimentary principles upon which each is based. The composition and potentialities of the IBM, the MIT differential analyzer, Harvard's Calculator, The ENIAC, the Bell Labs Complex Computer, the Kalin-Burkhart Logical-truth Calculator, the Edsac, the Edvac and Univac are discussed. Just how far this delegation of reasoning to machines will go is something the author conjectures may ultimately be a responsibility of UN control if mankind is not to be a pawn of his own inventive brain. There is a comprehensive bibliography in a supplement.

Make PERMANENT CONNECTIONS Quickly

This big strong, heavy duty Sherman Solderless Lug is a favorite everywhere. It's easy to install, and it makes an efficient, permanent connection. Extra thread plate for strength. Floating pressure pad attached to screw. Serrated gripping surfaces. Sizes up to 500m CM. Write for catalog!

H. B. Sherman Mfg. Co.
Battle Creek, Michigan

Sherman
SOLDERLESS LUGS

All the strength and durability inherent in steel are combined—with definite economies—in *Crapo* Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

Ask the distributor of *Crapo* Galvanized Products near you or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE INDIANA

Practical Television Servicing and Trouble Shooting Manual. **Published by Coyne Electrical & Radio Television School, Chicago 12. 400 pages, illustrated. Price $4.25.**

The term "manual" in the title by no means signifies that the text is devoted to defining for a novice just what to do to each part of each commercial set for each possible form of malfunctioning. On the contrary, it reasons out what functional part of any set to test and adjust to correct the defective reception. In this sense the book serves very well to explain the principles and the orthodox behavior of the components. This is especially true of the 4-color diagrams explaining the technique of color television. Unfortunately there is little subject matter on external interference, but the well informed utility communication engineer can infer how various disturbing effects can be identified.

Fourier Methods. **By Philip Franklin. Published by McGraw-Hill Book Co, New York 18. 289 pages, illustrated. Price $4.00.**

This is a compact and concise MIT text which presupposes only a first course in calculus in developing the mathematical techniques of complex quantities, Fourier series, harmonic analysis, partial differentials, boundary valve studies and Laplace transforms. The phenomena analyzed in examples are largely from electric circuits and the field of heat flow. Transients in both fields are given special attention. Answers are given to the numerical exercises dispersed among text paragraphs.

Basic Television, Principles and Servicing. **By Bernard Grob. Published by McGraw-Hill Book Co, New York 18. 596 pages, illustrated. Price $6.50.**

First in the recently inaugurated television series, this book by an instructor in RCA Institutes is professionally addressed to radio technicians and servicemen. But the caliber and the scope is such that anyone familiar with radio fundamentals should be able to extend his grasp unmathematically into television. Starting with the camera tubes, scanning synchronizing, the picture carrier signal and frequency modulation, the descriptions and explanations proceed to the receivers, picture tubes, power supplies and video amplifiers. By this time the student is ready for exposition of the elements of the sets and antennas which can exhibit faulty performance. Then ensues the chapter on servicing which diagnoses the characteristic misbehaviors and interferences. A later chapter outlines the problem of color television.

GOLDEN 50th ANNIVERSARY

The Gift of Connoisseurs

ORIGINAL DeLuxe

"The FRUIT CAKE Without an Equal"

COLLIN STREET BAKERY CORSICANA, TEX

PAGE FENCE - Since 1883

• AMERICA'S FIRST WIRE FENCE •

Fence MEN AT WORK

● Yes, Page Chain Link Fence works day and night as protector of persons and property against common hazards. In your industry protective requirements are exacting. Needs vary according to location and conditions. For you we have a valuable new booklet and detailed data on the several styles of Page Fence and Gates and the choice of metals available. It tells why you can expect the best of fence engineering and erection service from the long-experienced Page Fence specialist near you—a firm which knows local conditions. Name and address will be sent with booklet DH-142. Write for it.

Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Los Angeles, Philadelphia, Pittsburgh, New York or San Francisco.

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

IT'S A KNOCK-OUT PUNCH

and it's HYDRAULIC

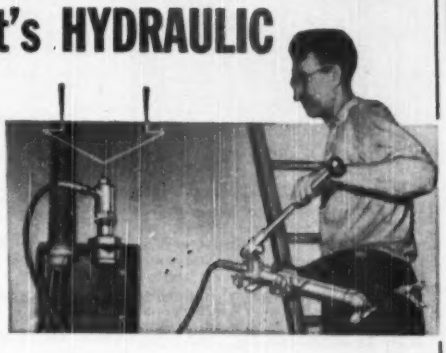
NO WRENCH TO SWING

● Save at least 60% in job time

● No Box Distortion

● Close-Quarter Operation

● Greater Safety



Now you can punch conduit openings in electrical distribution boxes, pull boxes, etc., with smooth *hydraulic power!* Yes, punch 'em with ease for ½" up to 4" conduit. There's a kit for every range. Use the same "Porto-Power" hydraulic pump and fittings which serve Blackhawk Benders. Hydraulic equipment available separately for present owners of manually-operated punches. Buy from leading supply houses. Get full facts on hydraulic equipment for installing conduit—rush coupon requesting Bulletin 50-B.

BLACKHAWK

BLACKHAWK MFG. CO.
Dept. P-4130
Milwaukee 1, Wis.

Without obligation, rush Bulletin 50-B.

Name.....

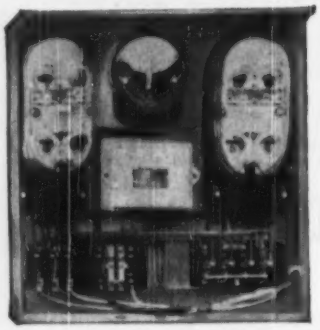
Firm.....

Address.....

City.....State.....

KEES
POLYPHASE METER BOXES

L16-W



No. 24-W-2 Front removed

KEES polyphase outdoor meter boxes feature knockouts for all probable hook-ups for polyphase meters, primary metering, time switches, and recording instruments. Front forms more than one-half the sides and bottom. Equipment can be reached from sides as well as from front. Weatherproof, waterproof front is hinged at top, easily detached. Latch may be sealed, and locked.

Write Dept. EW-5 for free catalog.

Since 1874

F.D.KEES MANUFACTURING CO.
BEATRICE, NEBRASKA

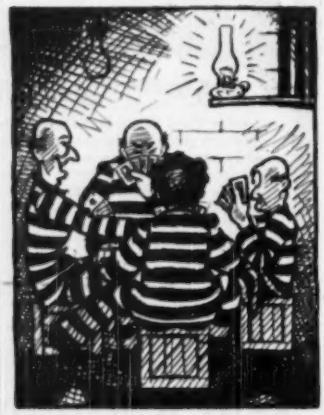
LETTERS TO THE EDITOR

They Don't Live Right

To the Editor of ELECTRICAL WORLD:

In glancing at February 13's ELECTRICAL WORLD, I find on page 63 under "Notes from the News" an item regarding the lack of electricity in the Lamoille County Jail at Hyde Park, Vt.

Under this it states that the Morrisville Light and Power Company (probably meaning our municipal plant) has cut off service on account of non-payment of electric bills.



". . . they are ruining their eyesight. . ."

Just to keep the record straight, the Lamoille County Jail is served from the Hyde Park Municipal system, and not ours, although we do sell wholesale power to the Hyde Park System.

It does inconvenience the four prisoners considerably as they are now unable to have one or more shower baths per day with hot water, and they are ruining their eye-sight playing Canasta each evening by lamp-light. This results in decreased desirability of free lodging at the expense of the state.

W. K. Sanders
Superintendent
Water and Light Department
Morrisville, Vt.

Justify House Heating Rate

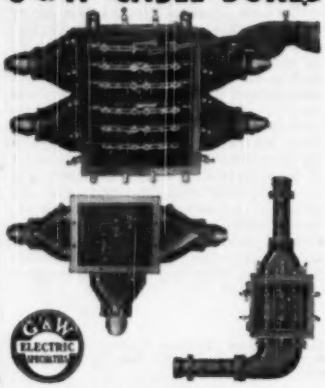
To the Editor of ELECTRICAL WORLD:

I hope your editorial of December 17th, "House Heating but No Data", arouses more interest in the subject. . . .

A few utilities, who have independence in rate making, have increased rates to procure an adequate return, but most of them are waiting to see what happens. In the meantime the

(*Continued on page* 155)

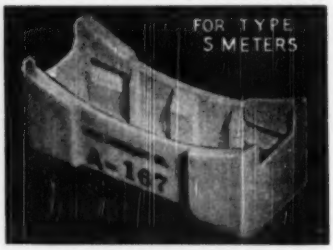
Interconnect with
G&W CABLE BOXES



WATER-TIGHT!

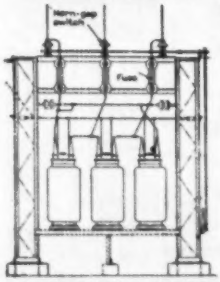
Low voltage boxes with fuses, links or bolted connections.
High voltage boxes—AIR filled for voltages up to 7500. Oil filled for higher voltages.
Standard and special forms and sizes.

G&W ELECTRIC SPECIALTY CO.
7786 Dante Ave. Chicago 19, Ill.
Representatives in principal cities



STAR METER SEAL
Eliminates meter tampering. Cannot be removed without mutilating. SEND FOR SAMPLE.
STAR PORCELAIN CO.
51 Muirhead Ave. Trenton, N. J.

MEMCO (SINCE 1918)



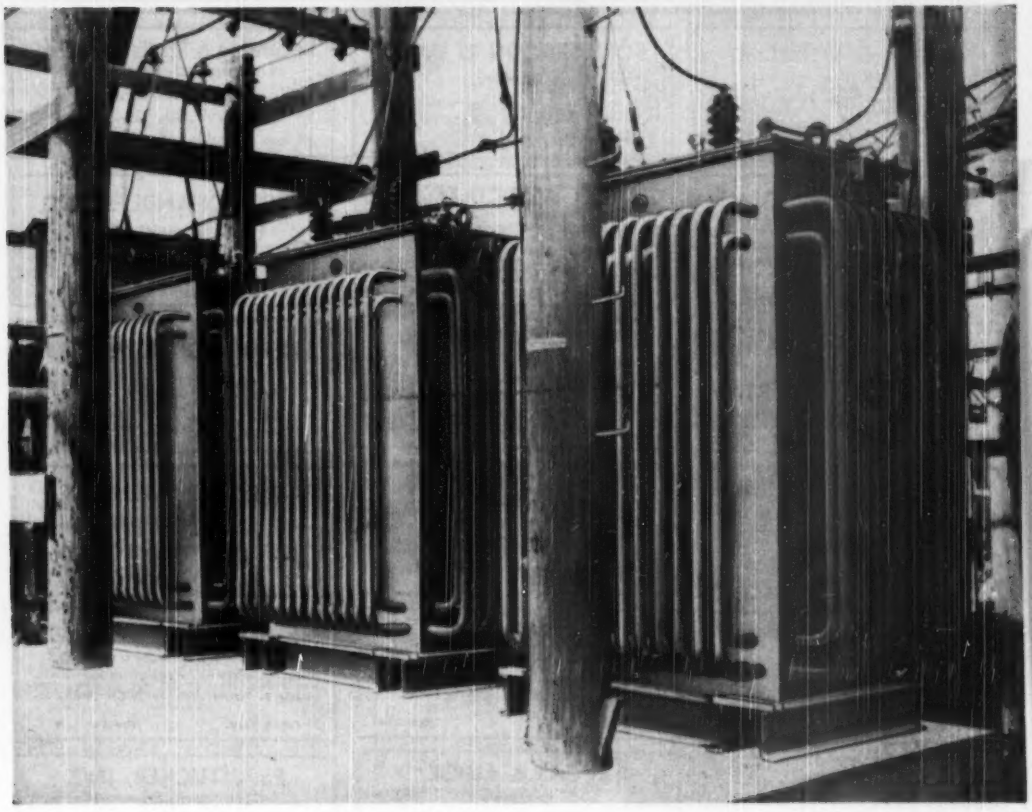
SUBSTATIONS
—
OUTDOOR & INDOOR SWITCHES
—
CONNECTORS
—
SLEEVES
—
FITTINGS
—

MEMCO ENGR. & MFG. CO., INC.
37-48 61 STREET WOODSIDE, L. I., N. Y.

LARKIN

TRANSFORMERS

ON THE JOB IN PENNSYLVANIA



3—667 KVA Oil Immersed Self Cooled Power Transformers Single Phase, 60 Cycle, Type AOP, 13,200 volts primary to 2300/4000Y secondary.

MANUFACTURED BY

LARKIN LECTRO PRODUCTS CORPORATION

PINE BLUFF • ARKANSAS

Sales Offices in Principal Cities

PROFESSIONAL SERVICES

BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
26 State Street, Albany, N. Y.

BLACK & VEATCH
Consulting Engineers

Electricity—Water—Sewage—Industry

Reports, Design, Supervision of Construction, Investigations, Valuation and Rates

4706 Broadway Kansas City 2, Missouri

HUGH L. COOPER & CO., INC.

General Hydraulic Engineering, including the design, financing, construction and management of hydro - electric power plants.

250 Fifth Avenue New York 1, N. Y.

DAY & ZIMMERMANN, INC.
Engineers

Design - Construction - Management
Investigations and Reports

Philadelphia
New York Packard Building Chicago

Doble Engineering Company
Electrical Insulation Engineers

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications

Office and Laboratory: Doble Park
Box 344, Belmont 78, Mass. (6 miles from Boston)
Branch Office: 20 N. Wacker Dr. Chicago, Ill.

Ebasco Services Incorporated
Engineers - Constructors - Business Consultants

Design and Construction
Financial and Operating Consultation
Investigations and Reports
Consulting Engineering

Two Rector Street New York

ELECTRICAL TESTING LABORATORIES, INC.

Laboratory Factory and Field Investigations
Inspections and Associated Services
Certification

2 East 63rd Avenue at 79th St., New York 21, N. Y.

ROBERT E. FOLEY CONSTRUCTION CORPORATION

Design—Surveys—Appraisals
Construction & Maintenance

Transmission—Distribution—Communication Lines
Substation, Radio and Television Towers

48 Griswold St. Binghamton, N. Y.

FORD, BACON & DAVIS
Engineers

DESIGN . CONSTRUCTION
VALUATIONS . REPORTS

New York . Philadelphia . Chicago . Los Angeles

GILBERT ASSOCIATES, Inc.
Engineers and Consultants

DESIGN AND SUPERVISION OF STEAM, HYDRO, WATER SUPPLY, SEWAGE DISPOSAL AND DIESEL PLANTS
Reports . Rates . Labor Relations . Safety
Purchasing . Costs . Laboratory

New York Reading, Pa. Washington
Houston Philadelphia

HARZA ENGINEERING CO.
Consulting Engineers

L. F. HARZA
E. MONTFORD FUCIK CALVIN V. DAVIS
Hydro-Electric Power Projects
Transmission Lines, System Management, Dams, Foundations, Harbor Structures, Soil Mechanics

400 W. Madison St. Chicago 6, Ill.

HOOSIER ENGINEERING COMPANY
Erecting Engineers
Transmission Lines, Substations

66 So. 5th St., Columbus, Ohio
327 South LaSalle Street, Chicago, Ill.
136 Liberty St., New York

N. A. LOUGEE & COMPANY
(Successors to J. H. Manning & Company)

REPORTS—INVESTIGATIONS—VALUATIONS
BUSINESS AND ECONOMIC STUDIES

120 Broadway New York

LUCAS & LUICK
Engineers

DESIGN, CONSTRUCTION, SUPERVISION, OPERATION, MANAGEMENT, APPRAISALS, INVESTIGATIONS, REPORTS, RATES

231 S. LaSalle St., Chicago

CHAS. T. MAIN, INC.
Engineers

Electric, Steam and Hydraulic Projects, Investigations, Reports, Designs and Appraisals

Chamber of Commerce Building
80 Federal St., Boston 10, Mass.

ARTHUR L. MULLERGREN
Engineering-Management
Public—Utilities—Natural Gas

Kansas City, Mo.

Recording & Statistical Corp.

BILL ANALYSIS—CONSUMPTION STUDIES
THE ONE-STEP METHOD
Bill Frequency Analyzer

100 Sixth Ave. WOrth 6-8236 New York 13, N. Y.

REIS & CHANDLER, INC.

ADVISORS TO UTILITIES

Financing—Rate of Return

30 Vesey Street, New York 7, N. Y.

SANDERSON & PORTER
Engineers and Constructors

New York Chicago
San Francisco Los Angeles

SARGENT & LUNDY

ENGINEERS

140 South Dearborn St.

Chicago, Ill.

F. W. SCHEIDENHELM
Consulting Engineer

Hydraulic Engineering, Hydro-electric Development, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law, Appraisals.

50 Church Street, New York 7, N. Y.

F. A. TUCKER, INC.
Contractors—Engineers

specialize in
Distribution - Transmission - Telephone lines - Maintenance - Roads - Bridges Dams

Main Office—38½ Center Street, Rutland, Vt.
Branch Office—120 East 3rd St., Charlotte, N. C.

UTILITIES LINE CONSTRUCTION COMPANY, INC.
Construction and Maintenance

Transmission-Distribution
Electric and Telephone Lines
Consultants

501 York Road 1240 Oliver Bldg.
Jenkintown, Pa. Pittsburgh, Pa.

THE J. G. WHITE ENGINEERING CORPORATION

Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

(*Continued from page* 152)

space heating load is fast getting out of hand, that is, it is being subsidized by other services to the point where it will be permanently subsidized.

Utilities, who purchase all their energy requirements from the Bonneville Power Administration, have their retail rates set by the Administration. Most of their residential customers receive energy under rates having an end rate of 3¼¢ per kwhr. It has been my position that BPA should carry on studies to prove that this low rate is justified or should make adjustments to cover this expensive type of service. I doubt if the utilities operating under the rates set by BPA will come through with any data for determining if the rates are proper, for the reason that they are small organizations and do not have the means of carrying on the necessary research. . . .

F. Ford Northrop
Asst to the General Supt
Eugene Water & Electric Board
Eugene, Ore. and
President Northwest Public Power Assn

Solution to Pecos Problem

To the Editor of ELECTRICAL WORLD:

I have read Arnold Benson's letter to the editor [in the January 16th issue of ELECTRICAL WORLD] regarding . . . the oil circuit recloser problem.

The problem . . . can . . . be solved without extra cost and almost no labor. If [he] will remove the neutral ground and float the Y-point of the transformer bank, [he] should have little or no trouble due to transient faults on the 12-kv side.

A. B. Weaver
Distribution Engineer
Central Power & Light Co
San Benito, Texas

Tetrachloride Fumes

To the Editor of ELECTRICAL WORLD:

Concerning George Spangler's item on his jet lubricator using grease dissolved in carbon tetrachloride (ELECTRICAL WORLD, Jan. 16, 1950, p 94) I feel you would be doing your readers a favor to point out that "carbon tet" fumes are dangerously toxic when inhaled, as pointed out in so many industrial safety bulletins. Plant safety men are usually aware of this, although many operators who actually use the stuff and who read ELECTRICAL WORLD are not. Although Trichlorethylene is not without some hazards, it is generally preferred by safety men to Carbon Tet, and it works just as well as a solvent.

J. F. Kalbach
Los Alamos, N. M.

Speeds trolley, fence and guy wire repair. Ideal for overhead work: weighs only 13 lbs., with 20¼" travel and 2 tons capacity. Speed trigger permits instant slack take-up when jack is not under load. Safety clip holds lever securely.

SEND FOR BULLETIN: UTILITIES 49

Simplex
LEVER • SCREW • HYDRAULIC
Jacks
TEMPLETON, KENLY & COMPANY
1040 S. Central Ave. Chicago 44, Illinois

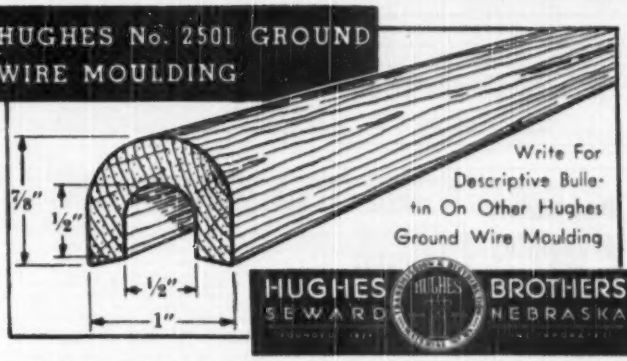
UNEQUALLED
. . . FOR MAKING LASTING SPLICES

. . . users who KNOW buy only the BEST

Ask for them by name . . .

OKONITE and MANSON tapes

HUGHES No. 2501 GROUND WIRE MOULDING



Write For Descriptive Bulletin On Other Hughes Ground Wire Moulding

HUGHES BROTHERS
SEWARD NEBRASKA

TUG-O-WHEEL AERIAL CABLE BLOCKS

For safe and speedy installation of all types of aerial cables. Job proven by many years of reliable service. It has been adapted as standard cable placing equipment by telephone and power industry.

BLOCK TYPE "A" For factory lashed power cable

BLOCK TYPE "B" For field lashed power cable

BLOCK TYPE "C" For all sizes of telephone cable

Full data and specifications covering our complete line of cable placing equipment is available to all outside Plant Construction Supervisors, write or call

TUG-O-WHEEL PRODUCTS CO., BALLSTON SPA, N. Y.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:
(Not available for equipment advertising)
$1.20 a line, minimum 4 lines.
To figure advance payment count 5 average words as a line.
INDIVIDUAL EMPLOYMENT WANTED undisplayed advertising rate is one-half of above rate, payable in advance.
PROPOSALS, $1.20 a line an insertion.

INFORMATION:
BOX NUMBERS care publication New York, Chicago or San Francisco offices. Count as 1 line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals.)

DISPLAYED RATE:
The advertising rate is $9.75 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. E. W.

NEW ADVERTISEMENTS received by 10 A. M. March 17th, will appear in the March 27th issue subject to limitations of space available.

DESIGN ENGINEER VACANCIES

Progressive and Growing Midwest Electrical Manufacturing Organization. One of the Leaders in Outdoor Electric Power Distribution and Transmission Equipment, Has Openings for:

(1) **Designers for High Voltage Air Break Switches and Related Equipment.**

(2) **Electrical and Mechanical Engineers for Development and Design of Distribution Protective Equipment.**

(3) **Designers Experienced in Stampings, Screw Machine Parts, and Other Mass Production Items Where Cost is a Vital Consideration.**

All Positions Are Permanent. Only Experienced Men Will Be Considered.

P-2040, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

SALES MANAGER AVAILABLE

Has had extensive experience in direct sales and sales promotion of electrical distribution and transmission equipment to Private, Public, and Municipal Utilities, and REA Cooperatives.

If you need aggressive and experienced young field Sales Manager, with an electrical engineering background, to supplement and direct sales efforts of your field organization, please contact me.

SA-2508, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

WANTED—ELECTRICAL ENGINEER

An established utility service organization has opening on its permanent staff for energetic graduate electrical engineer with at least 5 years recent electric utility system operating or management experience. Age about 35. Good opportunity. Salary commensurate with qualifications. Some foreign travel.

P-2499, Electrical World
330 W. 42nd St., New York 18, N. Y.

If you manufacture ELECTRICAL EQUIPMENT

and it is primarily for sale to original equipment manufacturers or industrials and if you are looking for good conscientious representation in the Metropolitan New York area, a manufacturers representative of over 25 years experience, with excellent contacts, expanding. Now handling intermediate integral horsepower motor and generator equipment. Write.

RA-2519, Electrical World
330 W. 42nd St., New York 18, N. Y.

Distributors Wanted by Transformer Manufacturer

SEVERAL EXCLUSIVE TERRITORIES AVAILABLE

EISLER ENGINEERING CO., INC.
CHAS. EISLER, PRES.
769 South 13th St • Newark, N. J.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

CONSULTING ORGANIZATION supervising operations of large number of electric utility systems requires active electrical engineering graduate, with General Operating Superintendent type of experience, capable of full responsibility electrical system maintenance, operation and betterment. Good opportunity for right man. Some foreign travel. P-2144, Electrical World.

POSITIONS VACANT

MANAGER TO oversee construction program and operation north middle west 45,000 KW generation and transmission cooperative system financed by the Rural Electrification Administration. Engineering or utility experience desirable. Executive competence primary requisite. Reply in detail to: Gerald C. Olson, Mooreton, North Dakota.

MANAGER FOR small REA distribution co-op in N. W. Ohio serving 1,860 members, 433 miles; office in town of 5,000, excellent schools and churches. Rural electrification, utility, engineering or management experience required. Write A. J. Flowers, Holgate, Ohio for application form.

FIRST-CLASS executive to oversee construction program and manage Missouri generation and transmission cooperative system. Management competence prime factor, with training in utility, engineering or cooperative fields desirable. Apply to L. L. Moran, Savannah, Missouri, Treasurer of N. W. Electric Power Cooperative.

SELLING OPPORTUNITIES OFFERED

SALESMAN OR Engineer now visiting utilities to handle reconditioned watthour meters, parts, etc. Commission basis. SW-1933, Electrical World.

ELECTRICAL PORCELAIN Sales Engineer wanted. Nationally known manufacturer of electrical porcelain has requirement for experienced and aggressive man to handle sales. Should have engineering background, electrical porcelain experience, complete understanding of markets involved, and be able to direct efforts of established field sales force. SW-2527, Electrical World.

EMPLOYMENT SERVICE

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service (40 years recognized standing and reputation). The procedure is highest ethical standards, is individualized to your personal requirments and develops overtures without initiative on your part. Your identity covered and present positions protected. Send only name and address for details. R. W. Bixby, Inc., 262 Ellicott Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

GRADUATE ELECTRICAL Engineer, 28, married, 15 years hydropower, utility, industrial engineering, planning, administration in America and Europe desires responsible position with utility, large mining or industrial enterprise in Northwest, Canada or Alaska. Replies: PW-1941, Electrical World.

SALES ENGINEER—calling on Electrical Distributors, Contractors, Utilities. New York State preferably, years of experience, excellent references. PW-2473, Electrical World.

DESIGNER-CHECKER. Over 14 years drafting and layout, complete—lighting to wiring diagrams in production buildings and power projects; practical work. Conscientious. Require minimum of supervision. Married with family. PW-2514, Electrical World.

SCHOOL

Electrical Meter Engineering
"The Profession With a Future"

Meter Department demands are bringing good opportunities to meter experts.
HOME STUDY COURSE
Practical up-to-date home study covers all phases of Meter Work
Write Today for Free Booklet
Fort Wayne Correspondence School
Dept. 135, 201 Dime Bank Bldg. Fort Wayne 2, Ind.

U. S. Government

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Specifications No. 2934) will be received by Bureau of Reclamation, Denver, Colorado, April 4, 1950, and then publicly opened for furnishing the following electrical equipment with range of voltages and capacities as indicated: distribution transformers, 12- to 43.8-kv and 3- to 112.5-kva; step-voltage regulators, 12-kv and 15- to 600-kva, 3-phase; power circuit breakers, 14.4- to 230-kv, 600- and 800-amp, and 100,000- to 2,500,000-kva; circuit reclosers, 12.5-kv, 100-amp, and interrupting rating of 2,000 amp at 15 kv; interrupter switches, 46- to 115-kv, 200-amp, and 200,000- and 500,000-kva; air switches, 15- to 230-kv, 400- to 1,200-amp; and disconnecting fuses, 15- and 46-kv, single-pole for substations, Central North Dakota Power System, Transmission Division, North Dakota, Missouri River Basin Project. Delivery is desired within 270 days. For particulars, address Bureau of Reclamation, Building 1-A, Denver Federal Center, Denver, Colorado.

MICHAEL W. STRAUS, Commissioner. (621)

FROM AVAILABLE STOCK

TURBO GENERATORS

KW	Make	Desc.
4000	G.E.	Axial extraction—350 lbs. I.S.P. 55 lbs. ext.—3300 v. 3 ph. 60 cy.
750	G.E.	Condensing—250 lbs. I.S.P. 440 v. 3 ph. 60 cy.—Built 1944
500	G.E.	Non-condensing 100/175 I.S.P. 5/10 B.P.—480 v. 3 ph. 60 cy.
400	Wtse.	Non-condensing 124/150 lbs. I.S.P. 5/10 lbs. B.P.—240/480 v. 3 ph. 60 cy.

SYNCHRONOUS CONDENSERS

KVA	Make	Type	Volts	Speed
5140	Wtse.		2400/4150	600
4000	G.E.	TSC	2400/4150	900
3000	Wtse.		2400/4800?	720

MOTOR GENERATOR SETS

3 ph. 60 cy.

KW	Make	Speed	DC Volts	AC Volts
1800	G.E.	600	125/250	2300/4150
1500	G.E.	300	275	2300/4600
1400	G.E.	360	275	2300/4150
1340	G.E.	600	275	4150
1000	Wtse.	900	600	4150

TRANSFORMERS—60 Cycle

Kva	Make	Type	Ph	Voltages
2000	Wtse.	OISC	1	69000x11000
2000	Al. Ch.	OISC	3	12300x2400
2000	Pitts.	AT	3	13800x2300
1250	G.E.	HVDOJ	1	69000x2400
1000	Pitts.	OISC	1	12300x2300
600	Al. Ch.	OISC	1	2300/4160x4200/4440
333	Pitts.	OISC	1	69400x2400
167	G.E.	HH	1	2400x240-480

FREQUENCY CHANGERS

2000	KW	G.E.	25/60 cy. 2300/2300 v.
600	KW	A.C.	25/60cy. 11000/2300v.

BELYEA COMPANY, INC.

OFFICE & SHOP
51 Howell St., Jersey City 6, N. J.

TRANSFORMERS FOR SALE

3—	1000 KVA A-Ch	13800-2400
3—	500 KVA G-E	2400-240/480
3—	500 KVA G-E	11500-2300/4000Y
1—	400 KVA G-E	13200-120/240
3—	333 KVA G-E	33000-2300/4000Y
3—	333 KVA G-E	13800-120/240
3—	333 KVA G-E	13800-230/460
3—	333 KVA G-E	11000-2300/4000Y
3—	333 KVA G-E	2400/4160Y-240/480
1—	250 KVA G-E	6900/11950Y-230/460
3—	200 KVA G-E	6900/11950Y-230/460
3—	200 KVA G-E	6600/11430Y-2300
3—	150 KVA G-E	22000-2300/4000Y
3—	150 KVA G-E	11000-2300/4000Y
3—	150 KVA G-E	6900-460/230
3—	150 KVA L-M	2400/4160Y-120/240

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair services on all makes of transformers

THE ELECTRIC SERVICE CO.
Cincinnati 27, Ohio

DIESEL POWER

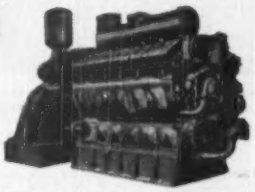
FOR

IMMEDIATE SHIPMENT

UNIT CAPACITIES—10 TO 1875 KVA

A.C.—50 AND 60 CYCLES

VARIOUS VOLTAGES



A PARTIAL LISTING OF OUR INVENTORY

KVA	Make	Model	HP	RPM	KVA	Make	Model	HP	RPM
1875	Fairbanks Morse	32F16	2000	300	375	Enterprise	DSG-6	450	450
1420	Fairbanks Morse	36D8½	1400	720	330	Superior	KNA	390	514
1250	General Motors	16-278A	1400	720	312	General Motors	6-268A	440	1200
937.5	General Motors	12-567	1080	720	312	Clark	MD-4	375	327
625	Alco	6-12½x13T	750	600	187	Ingersoll Rand	6	225	514
425	Baldwin	VO-6	510	450	125	General Motors	3-268A	180	1200
400	Buckeye	80	480	600	75	General Motors	6043C	90	1200

D.C. UNITS ALSO AVAILABLE

A. G. SCHOONMAKER COMPANY, INC.

ENGINE DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

SLIP RING MOTORS

1—2500 HP G.E. WT 257 RPM 6600V
1— 500 HP G.E. WT 720 RPM 2200 V 4150

SYNCHRONOUS CONDENSER

1—2500 KVA Wtse 720 RPM 2200 V with D.C. Exc.

MOTOR GENERATORS

1—1000 KW Wtse 275 V 720 RPM 4150 Volt
1—1000 KW G.E. 600 V 514 RPM 2200/4600 V
1— 500 KW G.E. 275 V 900 RPM 4150 Volt
2— 150 KW G.E. 125/250 V 1200 RPM 4150 Volt

TRANSFORMERS

1—5000 KVA Amer. 3 Ph. 27,000V, 2300V.
2—4500 KVA G.E. 3 Ph. 27,000V, 2300V.
1—1500 KVA G.E. 3 Ph. 4150 V 2300 V Pyranol
1—1000 KVA G.E. 3 Ph. 4150 V 2400 V
1—1000 G.E. 3 Ph. 4150, 2 Ph. 2400 V
2— 750 KVA G.E. 3 Ph. 4150 V 480 V Pyranol
1— 400 KVA G.E. 6900 2300 V Sec.
1— 100 KVA G.E. 4150-240/480 V Pyranol
1— 75 KVA G.E. 2400-240/480 V
1— 75 KVA Wtse 2300 230/115

Complete Line of A.C. and D.C. Motors and Generators

ELECTRICAL CABLE

- for every industrial and power application.
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular supplier.
- Cut to length. Reasonably priced.

UNIVERSAL Wire and Cable Co.
2870 N. Clybourn Ave., Chicago 14, Ill.

GENERAL MOTORS DIESEL

TWIN 6-71

$1750 per pair

MALTZ BROS.

U.S. Hiway #1 at Haynes Av., Newark, N.J.
Bi-3-4710

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES

No lengths too long or too short

Telephone: Eastgate 7-4778

PIERCE CABLE CO.
2670 Clybourne Ave. Chicago 14, Illinois

FOR SALE

1 675 HP. Worthington Air Injection Diesel Engine.
1 450 HP. Busch-Sulzer Air Injection Diesel Engine.

Including all auxiliaries, motor, generators, etc.
Can be seen in operation any time.

Contact Mayor or City Clerk
Independence, Iowa

MOTORS, GENERATORS, TRANSFORMERS
1 — 1500 H.P.
Bought and Sold
New and Rebuilt
ELECTRIC EQUIPMENT CO.
ROCHESTER 1, N.Y.

Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries, Transformers, Motors, Compressors, Induction Voltage Regulators, Oil Circuit Breakers, etc.

Service backed by 40 years' experience

BREW, WOLTMAN & CO.

52 Church St., New York 7, N. Y.

HEAT PUMP APPLICATIONS

New book provides a practical discussion of industrial, residential and commercial applications of the heat pump, including its operation, performance, and potentialities. Covers heat pump cycles, the thermodynamics of the heat pump, and includes temperature and design data. Describes compressors, fans and ducts, electric motors and accessories. By E. Kemler, Associate Director, Southwest Research Inst., and S. Oglesby, Purdue U. 300 pages, $6.00.

INDUSTRIAL ELECTRONIC CONTROL

New Second Edition

This manual explains fundamentals of electron-tube operation and shows how it is applied in basic circuits used in present-day industrial electronic control. All wiring diagrams agree with new AIEE Industrial Electronic Symbols. Covers types of electron tubes, circuit components, the use of electronics in closed-cycle controllers, and typical industrial circuits used in the field of instrumentation and motor control. By W. Cockrell, G. E. Co. 385 pages, $4.00.

RURAL ELECTRIFICATION ENGINEERING

Just out, this guide covers fundamental design features of rural distribution lines . . . the basic factors underlying the application of electricity to heat, light and power . . . and the administrative considerations underlying a sound rural electrification program. Types and materials of construction, layout, electric motors, electronics, etc., are discussed. By U. Earp, V.P.I., 313 pages, $3.50.

STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS

Here are thousands of facts and figures, systems and measurements, methods and materials from all fields of electrical engineering. This handbook covers everything from electric and magnetic circuits, regulators and reactors, and prime movers . . . to illumination, power system electrical equipment, and electronics and electron tubes. Prepared by a staff of specialists, A. Knowlton, Electrical World, Editor-in-Chief. 9th Edit., 2311 pages, $12.00.

SEE THESE BOOKS 10 DAYS FREE

McGraw-Hill Book Co., Inc., 330 W. 42 St., New York 18

Send me book(s) checked below for 10 days examination on approval. In 10 days I will remit for book(s) I keep, plus few cents for delivery, and return unwanted book(s) postpaid. (We pay for delivery if you remit with this coupon; same return privilege.)

- ☐ Kemler and Oglesby—Heat Pump Applications—$6.00
- ☐ Cockrell—Industrial Electronic Control—$4.00
- ☐ Earp—Rural Electrification Engineering—$3.50
- ☐ Knowlton—Standard Handbook for Electrical Engineers—$12.00

Name .....

Address .....

City ..... Zone ..... State .....

Company .....

Position W-3-13-50

This offer applies to U. S. only

Advertising in This Issue

Allis-Chalmers Mfg. Co. ... 7, 24, 25, 134, 135
Anaconda Wire & Cable Co. ... 8
Appleton Electric Co. ... 53

Bartlett Tree Experts ... 145
Bauer & Black Div. of Kendall Co. ... 121
Baxter & Co., J. H. ... 132
Bechtel Corp. ... 19
Bell Telephone Laboratories ... 36
Bendix Aviation Corp., Friez Instrument Div. ... 143
Bentley, Harris Mfg. Co. ... 10
Blackhawk Mfg. Co. ... 151
Blaw-Knox Co. ... 49

Chance Co., A. B. ... 115, 130
Chapman Chemical Co. ... 146
Chicago Pneumatic Tool Co. ... 26
Cobra Wood Treatment Corp. ... 140
Collin Street Bakery ... 151
Consolidated Treating Co. ... 22
Continental-Diamond Fibre Co. ... 58
Copperweld Steel Co. ... 39
Crouse-Hinds Co. ... 50, 51

Delta-Star Electric Co. ... Third Cover
Dow Chemical Co. ... 123
Directory of Engineers ... 154

Eisler Engineering Co., Inc. ... 141
Electric Controller & Mfg. Co., The ... 60
Electric Storage Battery Co., The ... 17
Electrical Engineers Equipment Co. ... 55
Engineers, Directory of ... 154
Everstick Anchor Co. ... 148

Federal Electric Products Co. ... 27
Four Wheel Drive Auto Co. ... 16

G&W Electric Specialty Co. ... 152
General Electric Co.
Apparatus Dept. ... 99, 100, 101, 103, 105
Construction Materials Dept. ... 144
Graybar Electric Co. ... 5
Grinnell Co., Inc. ... 59
Gulf Oil Corp. ... 62

Haley & Co., Inc., R. G. ... 147
Harper Co., The H. M. ... 149
Hazard Insulated Wire Works ... 4, 155
Hoskins Mfg. Co. ... 30
Hotpoint, Inc. ... 119
Hubbard & Co. ... 125
Hughes Bros. ... 155

Indiana Steel & Wire Co. ... 150
International Nickel Co., Inc., The ... 139
Irvington Varnish & Insulator Co. ... 18
I-T-E Circuit Breaker Co. ... 28, 29

Johns-Manville ... 147
Joslyn Mfg. & Supply Co. ... 11

Kees Mfg. Co., F. D. ... 152
Kerrigan Iron Works, Inc. ... 148
Kidde & Co., Inc., Walter ... 61
Kuhlman Electric Co. ... 41

Lapp Insulator Co., Inc. ... 42
Larkin Lectro Products Corp. ... 153
Line Material Co. ... 31, 32, 33, 34, 35

Marcus Transformer Co. ... 128
McCabe Powers Auto Body Co. ... 40
McGraw-Hill Book Co., Inc. ... 158
McGraw-Hill Pre-Filed Electrical Catalogs ... 147
Memco Eng. & Mfg. Co., Inc. ... 152
Miller Co., The ... 38
Moloney Electric Co. ... 108, 109
Monsanto Chemical Co. ... 47
Mosinee Paper Mills Co. ... 138
Murray Mfg. Corp. ... Second Cover

National Electric Products Corp. ... 66
National Telephone Supply Co., The ... 6
National Varnished Products Corp., The ... 63

Ohio Brass Co. ... 113
Okonite Co., The ... 4, 155

Pacific Electric Mfg. Corp. ... 43
Page Fence Assoc. ... 151
Page Steel & Wire Div. American Chain & Cable ... 115
Pennsylvania Transformer Co. ... 111
Penn-Union Electric Corp. ... 9
Porcelain Products, Inc. ... 12
Power Equipment Co. ... 122

Railway & Industrial Engineering Co. ... 15
Revere Copper & Brass, Inc. ... 107
Rockbestos Products Corp. ... 133
Rohm & Haas Co. ... 129
Ryerson & Son, Inc., Joseph T. ... 137

Sangamo Electric Co. ... 14
Searchlight Section ... 156, 157
Sherman Mfg. Co., H. B. ... 150
Simplex Wire & Cable Co. ... 23
Smith & Co., Gordon ... 150
Southern States Equipment Corp. ... 13
Spang-Chalfant Div. of National Supply Co. ... 45
Square D Co. ... 46
Standard Oil Co. (Indiana) ... Fourth Cover
Standard Transformer Co., The ... 44
Star Porcelain Co. ... 152

Tel-E-Lect Products, Inc. ... 149
Templeton, Kenly & Co. ... 155
Tug-O-Wheel Products Co. ... 155

Uptegraff Mfg. Co., R. E. ... 117

Van Cleef Bros., Inc. ... 54
Victor Insulators, Inc. ... 131

Wagner Electric Corp. ... 52
Westinghouse Electric Corp. ... 20, 21, 37, 48, 56, 57, 64, 65, 127

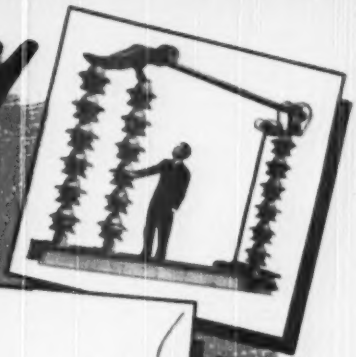
PROFESSIONAL SERVICES ... 154

SEARCHLIGHT SECTION
(Classified Advertising)

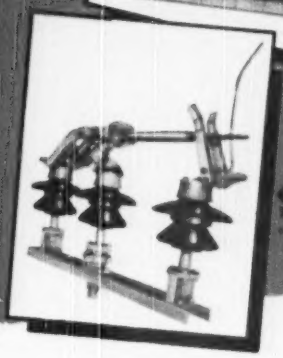
EMPLOYMENT
Positions Vacant ... 156
Selling Opportunities Offered ... 156
Positions Wanted ... 156
Selling Opportunities Wanted ... 156
Employment Service ... 156
EDUCATIONAL
Schools ... 156
NOTICES
Proposal ... 157
EQUIPMENT
(Used or Surplus New)
For Sale ... 157
WANTED
Equipment ... 157

Your Best Buy

THE "MK-40"
The Standard of Comparison



230 Kv., 1200 Amperes "MK-40" with Grounding Switch



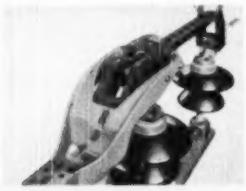
13 Kv., 600 Amperes "MK-40" Single-Pole Unit

115 Kv., 600 Amperes "MK-40" Single-Pole Unit

Universal acceptance by operating engineers is abundant proof of the sound engineering principle incorporated in the design.

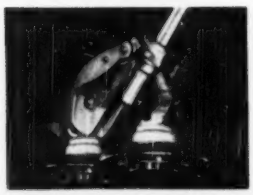
Its simplified construction and improved high pressure contacts at both ends of the blade insure the highest mechanical and electrical performance under the most severe weather and service conditions.

You can select a Delta-Star group-operated "MK-40" switch for every type of service, from 7.5 thru 230-kv and current ratings to 5000 amperes.



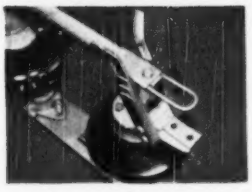
CURRENT PATH

From terminal to terminal the number of current interchange surfaces is reduced to an absolute minimum. Both ends of the floating tubular blade have the same type of reliable high pressure contacts backed by independent pressure applying members. There are no other moving contact surfaces or springs. Everything is in plain view for visual inspection.



BLADE MECHANISM

Fully controlled blade is actuated by a 45-degree bearing mechanism which replaces cranks, levers, links and cams. It converts motion of operating insulator to a vertical lifting and rotating motion of the blade, with a smooth sequence and just the right mechanical advantage. Blade locks automatically in both opened and closed positions.

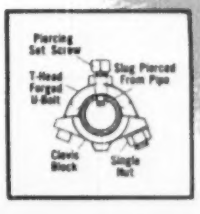


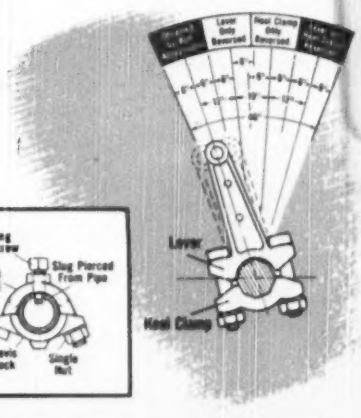
CONTACTS

Current carrying function of the contacts is independent of the pressure applying members to take full advantage of the electrical and mechanical characteristics of the materials used. Hard drawn copper shoes have heavy silver inlays. Ample material for heat dissipation assures high thermal conductivity. Uniform contact pressure is maintained by long, beryllium copper springs which carry no current.

OPERATING MECHANISM

Switch and control bearings have greaseless non-rusting ball bearings—insure free operation under all weather conditions. Self-piercing set screws on clamp type U-bolt fittings eliminate threading and drilling of pipe. Completely adjustable lever can be installed or removed without disturbing rotating insulator.





WHEN YOU WANT THE BEST IN HIGH VOLTAGE SWITCHES SPECIFY THE "MK-40"

DELTA-STAR ELECTRIC COMPANY

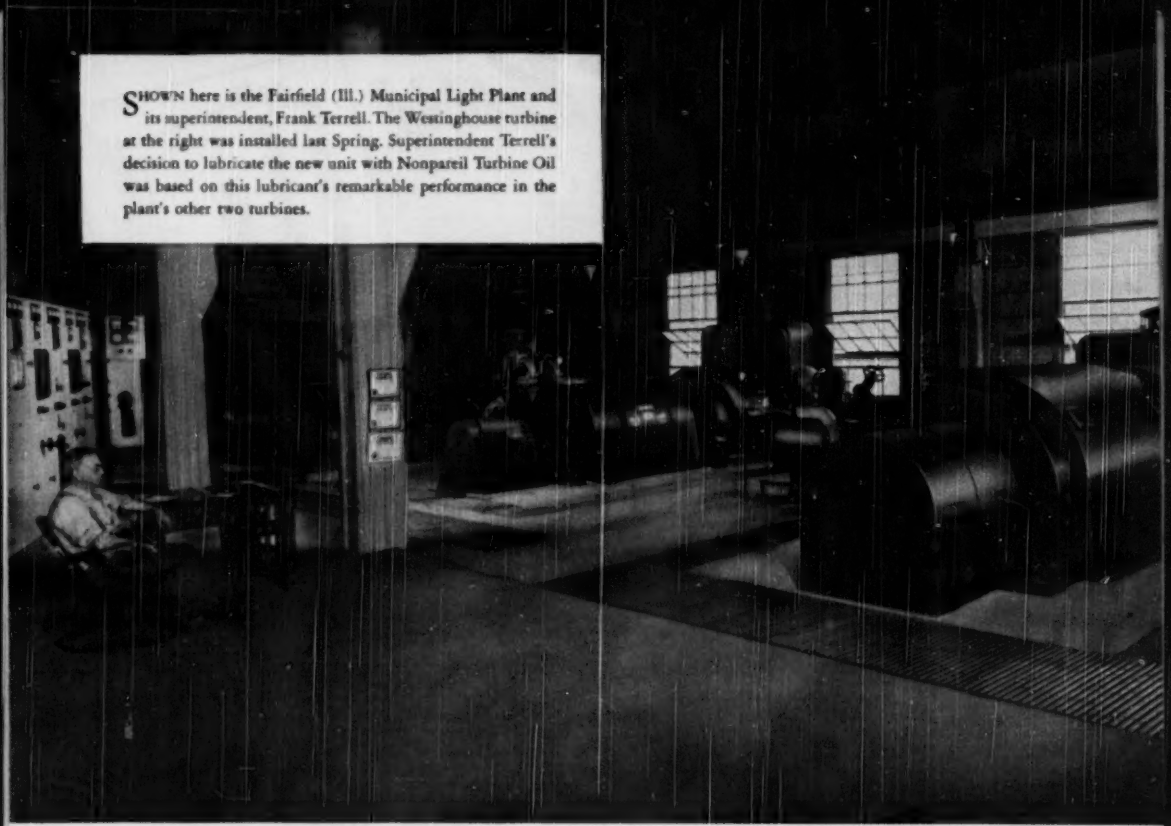
MAIN OFFICE AND FACTORY — 2400 Block, Fulton St., Chicago 12, Ill.
NEW YORK OFFICE — 130 Cedar St., New York 6, N. Y.

DISTRICT REPRESENTATIVES IN THE FOLLOWING CITIES

Birmingham, Ala.
Boston, Mass.
Buffalo, N. Y.
Charlotte, N. C.
Cleveland, Ohio
Dallas, Texas
Denver, Colo.
Detroit, Mich.
Indianapolis, Ind.
Jacksonville, Fla.
Kansas City, Mo.
Knoxville, Tenn.
Los Angeles, Cal.
Minneapolis, Minn.
Norfolk, Neb.
Norfolk, Va.
Philadelphia, Pa.
Pittsburgh, Pa.
Richmond, Va.
Roanoke, Va.
St. Louis, Mo.
San Francisco, Cal.
Seattle, Wash.
Tampa, Fla.
Washington, D. C.
Honolulu, Hawaii

CANADIAN ASSOCIATE

Canadian Line Materials Limited — Toronto, Ont., Canada



SHOWN here is the Fairfield (Ill.) Municipal Light Plant and its superintendent, Frank Terrell. The Westinghouse turbine at the right was installed last Spring. Superintendent Terrell's decision to lubricate the new unit with Nonpareil Turbine Oil was based on this lubricant's remarkable performance in the plant's other two turbines.

Here's minimum turbine-oil maintenance

CENTRIFUGING once a year is the only turbine-oil maintenance found necessary at the Fairfield Municipal Light Plant, Fairfield, Illinois. This practice has been followed ever since 1940, when Nonpareil Turbine Oil first went into the plant's new 1500-KW Westinghouse turbine. The same routine has been employed on a second Westinghouse unit of 2500 KW, installed in 1942.

During these 8 and 10 years of operation, the original fills of Nonpareil have not been removed either for treating or for replacing. Neutralization numbers have stayed below 0.08 mg KOH/gm. Oil systems have remained entirely clean.

Such lubricating economy and efficiency is not limited to 10- or 15-year records with Nonpareil Turbine Oil. Each fill of Nonpareil carries a written guarantee that it will remain below a neutralization number of 0.15 mg KOH/gm. *for the life of the turbine* it lubricates. 21-year service records of Nonpareil provide evidence of its ability to end acidity trouble and oil maintenance once and for all.

A Standard Oil Lubrication Engineer will be glad to supply you with actual case histories of utility operations in which Nonpareil Turbine Oil has reduced lubrication costs as much as 68%. Your letter will obtain the Engineer's services.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

NONPAREIL
Turbine Oil

"Will outlast your turbine"

STANDARD OIL COMPANY (INDIANA) STANDARD